

ENERGY EFFICIENCY RESEARCH IN CORPORATE REAL ESTATE

Charrette Meeting Report
August 1, 2006



Rocky Mountain Institute
1215 Spruce Street, Suite 301
Boulder, CO 80302
303.449.5226 p

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CoreNet Global
260 Peachtree St. NW, Suite 1500
Atlanta, GA 30303
404.589.3200 p

TABLE OF CONTENTS

<i>Executive Summary</i>	3
<i>Identification of Supply-Chain Participants</i>	4
<i>Discussion of Barriers</i>	5
<i>Revisiting Historical Barriers</i>	8
<i>Discussion of Enablers to Overcome or Remove Barriers</i>	13
<i>Case Study Goals and Project Suggestions</i>	15
<i>Next Steps</i>	17
<i>Appendices</i>	18
Appendix A: Charrette Agenda	18
Appendix B: Project Advisory Team Members	19
Appendix C: Rocky Mountain Institute Project Team	20
Appendix D: Platinum & Gold LEED Project List	22
Appendix E: Literature Review	33
Appendix F: Rough Meeting Notes – 8/1/06	40
Appendix G: Introductory Presentation	48

EXECUTIVE SUMMARY

On August 1st, CoreNet Global hosted the first of two advisory team meetings in its Atlanta offices. Approximately half of the 30-member advisory team was in attendance or joined in by conference call.

After an introductory presentation by Greg Franta that highlighted project goals, Eric Bowles facilitated a discussion of key supply-chain participants (see Appendix G). Real-estate developers, architects, business unit managers, corporate policy makers, finance/tax departments, facility/building managers, and corporate facility departments emerged as the key participants.

Approximately 70 barriers and over 60 enablers were identified during the morning and afternoon discussions. Noted barriers were quite diverse spotlighting challenges in all phases of a project from inception to operation. Enablers were similarly original ranging from the creation of new energy benchmarking databases to the launch of CEO-inspired energy initiatives. The barriers and enablers that received the most attention during the discussion include the following:

HIGH PRIORITY BARRIERS:

- Lack of clearly stated energy-related goals by CEO/corporate leadership
- Too much focus exclusively on \$/sf
- Lack of integrated design
- Lack of training/retraining for building/facility managers

HIGH PRIORITY ENABLERS:

- Hold goal-setting session with owner
- Host facilities maintenance staff conventions (maintenance staff convene to observe a single building and determine how it can be improved – they then return to their own facilities and make improvements)
- Encourage pre-lease energy audits – link efficiency improvements to TI work
- Provide comprehensive O&M training (supply DVDs)
- Create a building benchmarking database (data allowing companies to know “where they stand” compared to competitors)

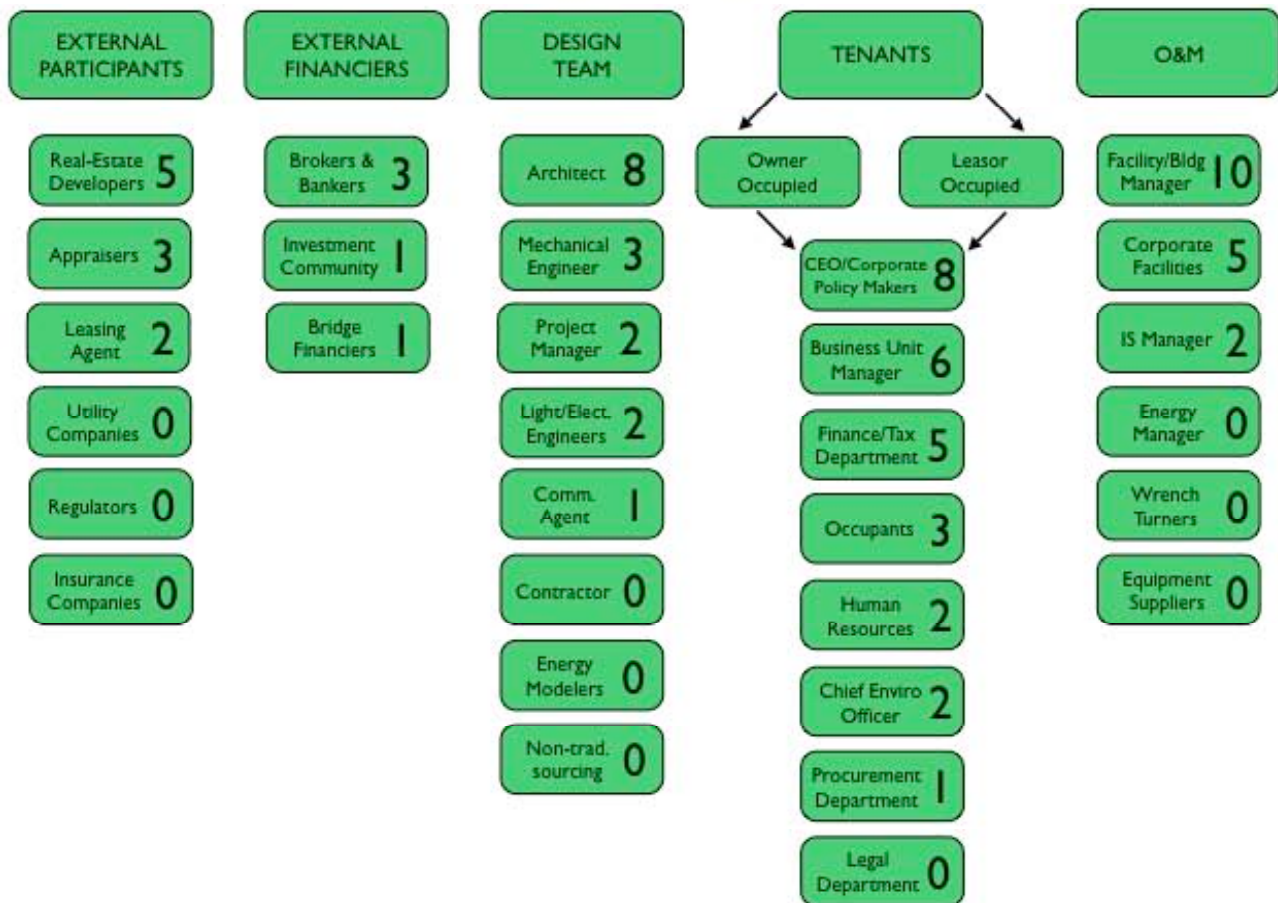
During the case study discussion, several specific projects were identified as either potential case studies or “sidebar” candidates (see pages 17-19). Numerous attendees noted they would like additional time to sort through potential projects.

The information collected during this meeting will form the basis for the upcoming survey/s to be completed by mid-August. The Zoomerang survey/s will be administered to CoreNet member companies and will take no longer than 15 minutes to complete.

The next advisory team conference call will be Tuesday, September 12th at 11am EST.

IDENTIFICATION OF SUPPLY-CHAIN PARTICIPANTS

Supply-chain participants coordinate the implementation of energy-efficiency measures. They are responsible for generating and executing great ideas. Identifying the key players in the building supply-chain is essential in order to discern which participants are best positioned to spark change. The diagram below illustrates the outcome of the supply-chain participant discussion. Each charrette attendee was given 6 dots to place on their highest priority participant – the numbers represent the number of dots each supply-chain participant received.



Based on the responses, it is evident that a few participants seem to be particularly important in the quest for energy efficiency in corporate real estate. These participants range from real-estate developers and architects to corporate policy makers and building managers. While these participants elicited the greatest interest from charrette attendees, the above figure clearly illustrates/shows that the discussion involving energy efficiency investments impacts a wide-ranging group of stakeholders, both internal and external to a corporation.

DISCUSSION OF BARRIERS

Barriers, by definition, stand in the way of achieving a desired outcome. Our purpose here was to identify barriers standing in the way of realizing greater energy efficiency in corporate office and warehouse facilities. As in the discussion of supply-chain participants, each meeting attendee was given dots to prioritize barriers. Furthermore, the barriers (and enablers) were separated into six categories: 1) financial barriers, 2) tenant/occupant barriers, 3) design barriers, 4) construction/o&m barriers, 5) metrics/other barriers, and 6) attitudinal barriers.

VOTES	FINANCIAL BARRIERS
9	Focus exclusively on \$/sf
5	Cannot quantify value of energy-efficiency measures
5	Appraisal/market value of buildings does not include energy-efficiency
4	Short-term leases discourage energy investments
4	Split incentives between owner/tenant
4	Pass-through expenses
3	Short-term flexibility vs long-term financing
2	Capital budgets vs operating budgets
2	Life-cycle analysis takes time and money
2	Uncertainty and real options are not considered in financial analyses
1	Component by component cost analysis
1	Pays flat rate per sf for energy (predictability of costs valued)
0	Difficult to figure out/analyze benefits of tax credits
0	Gross leases give no incentive for energy investment
0	Capital availability - choosing other investments over energy-efficiency
0	Premium cost for renovations
0	Lack of insurance/tax incentives
0	Lack of utility incentives

VOTES	TENANT/OCCUPANT BARRIERS
2	Takes low bids for design/construction work
1	Too much emphasis on rates rather than on energy use
1	Little in-house energy expertise
0	Occupants not given instructions on how to improve performance
0	Neighbors benefit equally from energy measures you implement
0	No incentive/difficult to obtain internal energy data
0	Knows of few examples of energy-efficient design
0	Lack of corporate knowledge - "will it work for us?"
0	Assumption that "this doesn't apply to me"
0	Multiple workstations and increased mobility

VOTES	DESIGN BARRIERS
8	Lack of integrated design
3	Excessive safety margins instead of better systems monitoring
2	Lack of incentives and performance-based contracts
2	Compressed project schedules
2	Experience level of design team
2	Does not emphasize whole-systems design
1	Percentage or flat-fee contract does not incentivize extra effort
1	Pushes budget and schedule, not goal setting or communication
1	Involves key players too late in the game
1	Paid based on value of deal, not long-term financial performance
1	Oversizes equipment to avoid liability
1	Doesn't build energy model for project
0	Need to customize energy package for each client
0	Leaves sizing of equipment to manufacturers
0	Delegates work to outside consultants
0	Isolating metering is difficult
0	Uses rule-of-thumb design

VOTES	CONSTRUCTION/O&M BARRIERS
3	Lack of training/retraining for building operators
3	Doesn't receive enough training on building systems
3	Paid to make things work, not to make them work efficiently
0	Sunk costs - when should equipment be replaced?
0	Difficult to order/purchase energy-efficient products
0	Availability often dictates equipment or material selection
0	Has inadequate systems monitoring or interfaces

VOTES	METRICS/OTHER BARRIERS
5	No statistics showing after-the-fact energy use versus design capacity
2	Lack of corporate (or industry) best practices for efficiency
2	Timing of information (access to)
1	Few metrics against which to compare energy costs
1	Prescriptive contracts as a result of too few best practices
1	Legislation doesn't push US companies on enviro issues
1	Lack of general knowledge base
0	Building standards - "this is the way we've always done it"
0	Disconnect amongst technical languages
0	Little demand for green buildings
0	Energy is a profit center
0	Technologies change quickly

VOTES	ATTITUDINAL BARRIERS
9	Lack of clearly stated energy-related goals by CEO/corporate leadership
3	Attitude: Lack of leadership, skill, or desire
3	Commissioning process not fully embraced
1	Believe energy-efficiency measures will increase first costs
1	Risk at all steps/fear of failure
1	Risk perception
1	Architect/engineer partnerships not strong enough
0	Single investments vs culture of change (annual energy budget)
0	Complexity and compromises dominate design
0	Value location and aesthetics not energy-efficiency
0	Is unfamiliar with project goals and sensitivities

Several other comments, mentioned during the group's discussion, did not make their way into the above matrices. These include:

- Energy investments in the US are driven by financial consideration, whereas investments in Europe are driven by sustainability considerations;
- Information systems restrictions may make it difficult to install energy monitoring or other related software on computer systems;
- Information technology (IT) personnel create data rooms that are energy intensive; however they resist incorporating energy-efficiency for fear of IT interruptions or data loss;
- Complexity of market (many different vendors supplying different information) and rapid technological change create a tendency to wait before making energy efficiency investments.



REVISITING HISTORICAL BARRIERS

Following the discussion that focused on the barriers to achieving energy efficiency, Bill Browning facilitated a conversation about the present status of the energy efficiency barriers identified in the 1992 Lovins study, *Energy-Efficient Buildings: Institutional Barriers and Opportunities* (those barriers are outlined in the attached literature review). Statements made during the discussion underscored the progress that has been made regarding energy-efficiency in the real estate industry over the last 14 years.

Financial Barriers

Barrier: Developers are more concerned with minimizing capital cost per square foot of net marketable floorspace, than with maximizing the building's long-term financial performance. Similarly, brokers, mortgage bankers, and investment advisors are rewarded based on the original project value, not on the building's long-term financial performance.

Current Status: There is no current evidence that developers are seeking improved long-term financial performance resulting from incorporating energy efficiency measures. Furthermore, brokers, mortgage bankers, and investment advisors are not being rewarded for incorporating energy efficiency measures in current building projects. DTZ has a recent study in the UK that points out the likelihood of the new building rating system impacting property values.

Barrier: The additional value of energy-efficient commercial buildings is rarely reflected in the appraisal process, security ratings, or market value. Often, emphasis is placed solely on market conditions, aesthetics, and location – low operating costs or innovative technologies are rarely highlighted.

Current Status: HOK is working with developers who have witnessed lease rates increase and timing between turnover of lessors decline for buildings that incorporate energy efficiency; however, the appraisal process still does not reflect the benefits of energy efficiency. One issue identified by participants is that there is some subjectivity in the performance of energy efficiency measures unless the LEED rating system is used. In the UK, it is likely that all buildings will be soon be rated for energy efficiency.

Barrier: The concept that capital cost can be reduced through thoughtfully designed building systems seems far-fetched.

Current Status: The group agreed that education and evidence are required to convince decision makers that capital costs can actually be reduced by implementing/employing thoughtful design practices. Furthermore, collective experience suggests that decision makers remain unconvinced. One participant questioned how many corporations truly understand LEED-inspired building design and construction. In their evaluation of energy efficiency and LEED practices, most companies use cash flow analyses. Some companies use an Internal Rate of Return (IRR) metric; however, few analyses incorporate discount rates or tiered rates. There is also little evidence that firms are considering uncertainty or the probability of changes. The group noted that many executives believe that something better has to cost more. Thus, even if an investment that incorporates energy efficiency costs less, it still may require a rigorous body of evidence to convince decision makers.

Barrier: There is rarely a local average energy bill against which to compare your building's bill, due to relatively few commercial-sector "truth-in-renting" energy-disclosure rules.

Current Status: BOMA publishes energy cost data per sq. ft., but it is unclear if this data is widely known or used by corporations. Energy star target finder is a tool also used by corporations to benchmark energy performance, but it is often difficult to do energy use, benchmarking, particularly for industrial warehouse facilities. The multitude of space uses and configurations renders some benchmarking numbers irrelevant, creating cases where time-series benchmarking may be the most appropriate measure, especially if production output can also be included in the analysis.

Barrier: "Many commercial leases, too, are still written on a 'gross' basis (i.e., they include energy and other operating costs in a total rent figure), giving the tenant no incentive to save even though the landlord could in principle keep the saving. 'Net' leases reverse this problem to the extent that energy cost components typically for lights and plug loads but sometimes also for space-conditioning, are individually metered and billed. *Neither lease form, as conventionally written, gives both parties an appropriate incentive to save.*"

Current Status: This issue remains problematic and is particularly important if energy efficiency measures are to be incorporated in leased spaces. There are, however, fewer commercial leases that are written on a 'gross' basis, these days.

Design-related Barriers:

Barrier: To avoid liability, designers often round up equipment sizes or rely on advice from manufacturers creating ridiculous safety margins (as great as tenfold) – often without performing models to verify performance.

Current Status: Although the safety margin may have declined over the years, the use of a safety margin for equipment size is still common practice unless challenged. Right-sized equipment design based on performance models remain an elusive goal on a large number of projects and design teams.

Barrier: Furthermore, percentage-of-cost contracts reward oversizing of equipment.

"Designers who do extra work to design and size innovative HVAC systems exactly right, thereby cutting their clients' capital and operating costs, are directly penalized by lower fees and profits as a result, in two different ways: they are getting the same percentage of a smaller cost, and they are doing more work for that smaller fee, hence incurring higher costs and retaining less profit."

Current Status: Although some firms are paid for hourly work or provided a lump sum amount (e.g., HOK), many firms continue to receive compensation based on a percentage-of-cost method. The percentage-of-cost contract leads to the replication and slight modification of old design projects.

Barrier: A single entity rarely takes responsibility for ensuring designers communicate to create an integrated design.

Current Status: Different fee structures, perspectives, and technical languages inhibit interaction between designers; however, a shift toward integrated design is starting to happen.

Barrier: Most architects lack the time and knowledge to check the engineers' work for maximal energy efficiency.

Current Status: Most architects do not possess the education required to assure that the project's engineers are designing for maximum energy efficiency. While the architect may not be able to perform this role, a commissioning agent may be willing to challenge the engineer. This is also probably more beneficial, given that the best practice would be for a commissioning agent to be an owner's representative, not typically hired as part of the design team. Further limiting the ability to verify the engineer's work; following the completion of construction, it would be costly to look at costs of running the building, particularly because the building is not fully occupied just after construction. These circumstances create a situation where the engineer may add in a safety margin and "fudge" numbers so they resemble more closely the sizing requirements set forth in the design. The mechanical engineer is typically risk averse and oversizing equipment reduces liability. There is no easy way to determine if systems are oversized. It is more important to hit the ventilation targets than it is to assure the sizing and energy efficiency demands are met. One mechanism that may keep the engineers in line with the project's energy efficiency goals is the allure of future business with the architect and the client.

Barrier: Mechanical designers are brought on too late in the project, when the most critical decisions have already been made.

Current Status: This barrier may be shifting; the group agreed that MEP engineers and energy modelers are being brought onto projects earlier in the design process.

Barrier: Time-pressed superiors, as well as code officials, would rather approve safe and familiar designs. The U.S. Office of Technology Assessment summarizes: "It is usually easier for the designer to follow accepted, standard practice, especially if the designer's fee is the same in either case. And as one interviewee said, 'The path of least resistance does not include energy innovative design.'"

Current Status: Participants noted evidence from the adoption of LEED and construction in Chicago that this barrier may be changing. Furthermore, in some areas like San Francisco the approval process for LEED buildings is pushed to the front of the line.

Barrier: Price competition between engineers encourages fast and easy "catalog engineering," which is hardly engineering, but "only the application of crude and outmoded rules-of-thumb to selecting common listings from major vendors' catalogs. *This procedure is at the root of today's appallingly low mechanical-system efficiencies.*"

Current Status: The use of "catalog engineering" remains prevalent. Representatives from several firms that sell energy efficient equipment noted their motivations to sell up front value in energy efficiency measures into marketplace. While the catalog may be getting better, the acceptance of using this catalog hasn't changed.

Construction-related Barriers:

Barrier: Equipment availability sometimes dictates selection – whatever "equivalent" (usually in terms of capacity, not energy efficiency) pump or duct is handy may be installed.

Current Status: Currently, equipment choice is better, but this situation still happens. A shift occurs when a client/team is willing to wait for the right equipment, or when the contractor's experience leads to earlier equipment requests.

Barrier: Suppliers can be reluctant to sell new products – for example, “people who use imaging specular reflectors buy only half as many fluorescent lamps to go under them, so vendors may discourage competing products that save customers’ dollars and energy at the expense of their own sales.”

Current Status: This point has changed a lot with the proliferation of green products.

Barrier: The commissioning team is rarely rewarded for the initial building performance or for how well the building operators understand the building systems.

Current Status: The commissioning process is not fully embraced everywhere; it is a cost that people have a hard time accepting. Time pressure may also account for a reluctance to embrace/implement the process.

O&M-related Barriers:

Barrier: Building operators are usually poorly trained and tend to disable equipment or features they don’t understand. Also, monitoring equipment is rarely installed, thus creating a barrier to measuring actual building performance against intended building performance or warranty-related specifications. Furthermore, confusing building interfaces make it difficult for operators to understand, let alone optimize, building performance.

Current Status: This occurrence has not changed over the years. The number one issue at the facilities run by one charrette participant has been “how to get the operators to run the building as it is supposed to”. Not all building operators operate the building efficiently, and there is a dearth of documentation surrounding how the building should be operated.

Barrier: Building operators may never even see meter readings or utility bills.

Current Status: Some occupants receive meter data; however, even if these data are received, there is often a time lag. Real time monitoring is expensive. Often, whoever sees the accounts payable is the default energy manager simply because they pay the bills. There are few incentives for those individuals who receive usage data to actually take action.

Barrier: Tenants are seldom given instructions as to how they can positively influence building performance.

Current Status: This issue remains true.

Barrier: Commercial building operators are mostly concerned with occupant comfort and minimizing complaints.

Current Status: This issue remains true.

Barrier: There is little feedback to real-estate developers regarding occupant satisfaction – “The building industry is in this sense quite primitive: we would not dream of running a manufacturing business with so little and oblique contact with our customers, and if we tried to, we’d soon be out of business. But that is what the building industry tries to do with its complete disjunction of design, manufacturing, marketing, sales, delivery, repair, and renovation or demolition.”

Current Status: This issue may be changing, developers are increasing efforts to communicate with their tenants, and roll-over vacancy is now a bigger issue.

Tenant-related Barriers:

Barrier: Few commercial tenants are familiar with energy efficiency. “Notable exceptions exist: in Sydney, Australia, it has become fashionable to compete on how efficient and ‘smart’ one’s office building is, and many tenants ask penetrating questions about details of design and efficiency down to the component level.”

Current Status: While tenant familiarity with energy efficiency remains a barrier, engaging and informing tenants about energy efficiency presents a big opportunity. Issues that must be addressed include: comparability of energy efficiency measures, shorter lease terms that make energy efficiency investments with a payback of more than two years unattractive, the predominance of gross leases eliminate incentives for energy efficiency, and the perception of a tenant mind-space issue – tenants have no mind space for energy efficiency because they are focused on their jobs and lessees don’t want to require them to think about peripheral things.

Barrier: There are many misunderstandings regarding energy efficiency; retail managers treat energy bills as “immutable as death and taxes.” Furthermore, “A survey of small businesses found that energy efficiency was thought to require turning down heat or turning off lights.”

Current Status: As rates increase, these misunderstandings are being revisited; however, there is still room for major improvement in this area.



DISCUSSION OF ENABLERS TO OVERCOME OR REMOVE BARRIERS

An enabler is a tool or instrument used to accomplish a task or implement a process. Numerous enablers were identified to overcome barriers identified during the morning session. As in previous sessions, the enablers are grouped and prioritized.

VOTES	FINANCIAL ENABLERS
4	Whole-system life-cycle cost analysis
3	Actually use life-cycle analysis tools
2	Data on comparative costs of energy-efficient buildings
2	Federal, state, and local tax credits and/or energy modeling subsidies
2	Create visibility for energy costs in leases
2	Shared development of financial models for energy investments
1	Green REITS (real estate investment trusts)
0	Use track record of operating costs to encourage appraisers to incorporate energy efficiency
0	Dow Jones Sustainability Index
0	Sell PR value of energy-efficiency measures
0	Monetize financial energy benefits

VOTES	TENANT/OCCUPANT ENABLERS
6	Pre-lease audits linked to Tenant Improvement (TI) phase energy improvements
2	Pay energy costs per metered amount
1	Occupant/tenant user manual for space
1	Score each building in portfolio and hold one individual accountable
0	Gather historical data on energy use before signing lease
0	Quantify/get data on improved productivity
0	Demand energy audits for newly leased spaces
0	Create lease guidelines for energy-efficiency

VOTES	DESIGN ENABLERS
3	Hold a charrette early on
3	Publish summaries/mechanisms for performance-based (PB) fees
2	At risk contracts; contractor PB fees; bonuses
2	Let green projects go to the front of the approval line
2	Identify keys to integrated design process early on
1	Create baseline to compare to design case
1	Bring MEP modelers in early on
1	Provide/Develop a toolkit of design resources (or design and resources toolkit)
0	Make contracts reflect time expenditures during design

VOTES	CONSTRUCTION/O&M ENABLERS
6	"Wrench-turner" convention
4	Provide comprehensive O&M training (supply owners with DVDs)
3	Replacement cycle decisions
2	Demand and capture energy data
2	DVD systems manual
1	Provide scientific/diagnostic training to empower facilities maintenance staff
1	Commission building on seasonal or annual basis
1	Pilot studies on non "no-brainer" upgrades to convince business owners
0	Establish/provide an internal energy checklist by business unit
0	Require report on commissioning avoided-cost data
0	Set equipment to reflect actual use schedule
0	Recommission building to reflect changes in use

VOTES	METRICS/OTHER ENABLERS
3	Collect before and after data by measure completed
2	Create a building benchmarking database
1	Mandate certain data to be part of leases (building "nutrition sticker")
0	Create building ranking system within industry
0	Develop sustainable product standards
0	Prorate multi-use space by sf
0	Motivate changes in classification of buildings (class "A")
0	Developers/brokers distribute flyers to potential tenants on green features

VOTES	ATTITUDINAL ENABLERS
5	Hold goal-setting session with owner
4	Involve entire company in mission-oriented energy program
4	Develop internal enviro metrics (energy savings and emissions)
4	Provide media (videos) to excite decision makers about green building
3	Link financial rewards (for employees) to energy measures
3	Interview CEO's to find out what motivated their environmental agenda
0	Develop standard company metrics for energy-efficiency
0	Develop more award programs for green buildings
0	Develop strategic peer pressure presentations
0	Enhance recognition of green projects
0	Quantify benefits of greater employee retention
0	Leverage competition over environmental goals (Toyota vs Honda)

CASE STUDY GOALS AND PROJECT SUGGESTIONS

A series of case studies will be used in the final report to highlight proven strategies used to overcome distinct barriers. These case studies will be selected from a range of industries and represent different levels of energy efficiency. It was decided that projects chosen for case studies must be completed and operational. Also, to better substantiate the business case, it would be helpful if selected projects had at least one year of M&V data available.

Before diving into potential projects for the case studies, the group brainstormed other items that could be included in case studies or used as “sidebars” in the final report.

- Example of a “sustainable” lease
- Example of an RFP that includes energy-efficient mechanisms
- A focus on United Technologies Corporation’s integrated building control center
- A discussion of motivation triggers – what prompts a CEO to initiate a company-wide energy program . . . perhaps interview CEO’s from Bank of America, Wal-mart, GE, UTC, Toyota, etc. to find out – publish these interviews to put pressure on CEO’s who haven’t yet focused on, or made policy statements regarding energy-efficiency
- A comparison of business units within a particular company where one unit is making great strides in energy-efficiency and another is not
- A discussion of the Dow Jones Sustainability Index and how it (and other indices, e.g., the FTSE4Good) are affecting market change
- A few basic examples of green building design that range from standard to highly energy efficient
- An investment decision example . . . why an energy-efficiency upgrade in an existing building was made over another investment
- An integrated design example with M&V data

Following this brainstorm session, the group jumped right into specific project suggestions. It should be noted, however, that the following list of project ideas is by no means comprehensive. Rather, it summarizes ideas that were generated on the spot. Several attendees noted that they would email additional projects at a later time.

CASE STUDY NOMINATIONS

<u>PROJECT NAME</u>	<u>OWNER/DEVELOPER</u>	<u>CEO/INTERVIEW CANDIDATE</u>	<u>LOCATION</u>	<u>DATE COMPLETED</u>	<u>LEED STATUS</u>
PNC Firstside Center	PNC Financial Services Group	Gary Slauson	Pittsburgh, PA	2001	LEED NC Silver
Anixter distribution warehouse	Anixter Inc.	Robert W. Grubbs Jr.	Alsip, Ill	2004	LEED NC Certified
One Bryant Park	Bank of America	Mark Nichols	New York City, NY	2008	LEED NC Platinum
Toyota Portland Vehicle Distribution Center	Toyota Motor Sales, U.S.A., Inc.	?	Portland, OR	2005	LEED NC Gold
California Department of Education	CA Department of General Services	?	Sacramento, CA	2006	LEED EB Platinum
Missouri Department of Natural Resources	MO Department of Natural Resources	?	Jefferson City, MO	2005	LEED NC Platinum
Four Times Square	Durst Organization	?	New York City, NY	1998	-
ABN AMRO Bank Head Office	ABN AMRO	?	Amsterdam, The Netherlands	1999	-
HSBC Corporate Building	HSBC Bank	?	Mexico City, Mexico	2006	LEED NC Certified
Interface Showroom and Offices	Interface	Ray Anderson	Atlanta, GA	2004	LEED CI Pilot Platinum
Brengel Technology Center	Johnson Controls	John M. Barth	Milwaukee, WI	2004	LEED EB Gold

Other projects or companies mentioned include BP, VeriFone, Patagonia, SC Johnson, Wal-Mart, a UK multi-tenant project (architects: HOK), a LEED platinum office building in India, and a Phoenix call center (architects: HOK). Comments or clarifications on the above (or any additional) projects can be provided to Aalok Deshmukh and Eric Maurer of RMI (adeshmukh@rmi.org, emaurer@rmi.org).

NEXT STEPS

This charrette forms a basis from which to develop and implement the upcoming survey. The survey will be administered to CoreNet member companies and will take no longer than 15 minutes to complete – Eric Bowles noted that he fully expects a 60-70% response rate based on other invitation-only surveys he has administered. Prior to launching the actual survey, a pilot survey will be given to a select group to ensure responses provide useful data.

The survey content will be based on information gathered during the meeting and subsequent comments regarding this report. Specifically, several issues need to be addressed:

- 1) Should we create several different surveys aimed at different supply-chain participants?
- 2) How will we differentiate between owner-occupied buildings and non-owner-occupied buildings?

Further, case studies need to be identified and selected. Additional projects that highlight specific barriers and how they were overcome should be brought to the attention of Aalok Deshmukh and Eric Maurer of the RMI project team (please email to adeshmukh@rmi.org, emaurer@rmi.org).

Lastly, the final report will also include sidebars that illustrate unique energy efficiency practices or provide examples of numerous new energy efficient projects that are in the design or construction phase, and incorporate energy efficiency measures. For example, the report may highlight the steps taken during the design phase to incorporate energy-efficiency into a large, mixed-use development in Beijing's Feng Tai district. Ideas for these sidebars should be directed to Aalok Deshmukh and Eric Maurer of the RMI project team (adeshmukh@rmi.org, emaurer@rmi.org).

APPENDICES

APPENDIX A: CHARRETTE AGENDA

Energy Efficiency Research in Corporate Real Estate (EERCRE)
CoreNet Global & Rocky Mountain Institute
Tuesday, August 1st, 2006: 9am – 5pm

Project Goals:

Ultimately, this project will serve as a resource for corporate tenants to understand and remove barriers to achieving greater energy efficiency. The final report will provide them with an understanding of what the barriers are and how they can be removed. Additionally, case studies will provide examples of energy efficient buildings that have overcome the stated barriers.

Charrette Goals:

- 1) Define critical supply-chain participants
- 2) Outline barriers experienced by each supply-chain participant
- 3) Suggest methods to overcome or remove these barriers
- 4) Identify case studies to be used as model success stories

Introduction: Welcome remarks from CoreNet and RMI

Morning Session: Defining barriers from a Corporate Tenant's Perspective

This session will focus on defining barriers from a corporate tenant's perspective. Given that this report will serve as a tool for corporate tenants, what barriers to energy efficiency do tenants experience during the design, construction, and operation of buildings?

12:30pm Lunch Session: Case Studies

Afternoon Session: Creating powerful case studies and brainstorming solutions to barriers

A brainstorming session will provide possible case study candidates. Following the focus on case studies, the participants will be placed into small groups to discuss how barriers identified during the morning session can be overcome.

Recap: A brief description of the day's events followed by steps to be taken in the upcoming months.

APPENDIX B: PROJECT ADVISORY TEAM MEMBERS

<u>NAME</u>	<u>COMPANY</u>	<u>POSITION</u>	<u>PHONE</u>	<u>EMAIL</u>
Eric Bowles	CoreNet Global	Director, Global Research	404-589-3231	ebowles@corenetglobal.org
Ron Adams	CoreNet Global		44 1428 651140	Radam@corenetglobal.org
Greg Franta	RMI	FAIA, Principal & Team Leader	303-449-5226	gfranta@rmi.org
Aalok Deshmukh	RMI	Sustainable Design Consultant	303-449-5226	adeshmukh@rmi.org
Eric Maurer	RMI	Intern	303-449-5226	emaurer@rmi.org
Caroline Fluhrer	RMI	Intern	303-449-5226	cfluhrer@rmi.org
Bill Browning	Browning & Bannon LLC	Partner	202-470-0401	bill@browningplusbannon.com
Bill Frain	Staubach	Principal	312-245-5020	bill.frain@staubach.com
Jim Cooke	Toyota	AIA, Real Estate & Facilities	502-867-4622	jim_cooke@toyota.com
Tim Frank	Toyota	PE, Field Operations Manager	330-498-0609	tim_frank@toyota.com
Kelly Speakes	UTC Power	Sustainable Strategies Leader	860-727-2375	kelly.speakes@utcpower.com
Mary Ann Lazarus	HOK	Senior Vice President	314-754-3927	mary.ann.lazarus@hok.com
Mike Harris	Johnson Controls	Vice President, Energy Services	414-524-5450	michael.harris@jci.com
Brenna Walraven	USAA Realty Company	Executive Director	949-442-7700	brenna.walraven@usaa.com
Mukesh Khattar	Oracle	Energy Director	650-506-6980	Mukesh.Khattar@oracle.com
John Schinter	Jones Lang LaSalle			John.Schinter@am.jll.com
Chris Owens	Microsoft			chrisow@microsoft.com
Keith Tabacek	Sun Microsystems			keith.tabacek@sun.com
Stephen Smith	UK ABN AMRO			stephen.c.smith@uk.abnamro.com
Timo Salonen	Nokia	Electrical and IT Solutions Manager	358-40-042-3938	Timo.M.Salonen@nokia.com
Mia Ranta-aho	Nokia	Environmental Solutions Manager	358-50-383-9490	mia.ranta-aho@nokia.com
Joe Wick	Cushman & Wakefield	Managing Director	212-709-0767	Joe.Wick@cushwake.com
Bill Sisson	United Technologies	Director, Sustainability	860-610-7317	sissonwm@utrc.utc.com
Gary Jensen	Ford Motors	Senior Architect-Planner	313-220-7928	gjensen@ford.com
Andy Bray	Johnson Controls	Head of Energy Services, EMEA	01252-451000	andrew.bray@jci.com
Kevin Oakes	Motorola	Sr. Manager of Strategic Sourcing	847-576-1092	kevinoakes@motorola.com
Pat Crumley	Staubach			Pat.Crumley@Staubach.com
Brad Hancock	Dept. of Defense			Brad.Hancock@osd.mil
Nick Axford	CB Richard Ellis Ltd	Head of EMEA Research & Consulting	44-020-71823039	nick.axford@cbre.com

* Indicates attendance at meeting; ** Indicates participation via conference call

APPENDIX C: ROCKY MOUNTAIN INSTITUTE PROJECT TEAM

Greg Franta, FAIA
Principal Architect and Team Leader

From 1981 to 2005, Mr. Franta led ENSAR Group in providing services on more than 800 energy efficient and environmentally sound projects, including offices, laboratories, educational buildings, health facilities, libraries, homes (including the White House), and other buildings—many considered the most energy efficient in the United States. Mr. Franta's work is widely recognized and he is the recipient of the 1998 AIA Colorado Architect of the Year Award. He has served on the National Board of Directors for the American Institute of Architects and is a co-founder (past Chairman) of the AIA Committee on the Environment. He participated in the development of the U.S. Green Building Council's LEED program; he is a LEED Accredited Professional, LEED trainer for USGBC, and part of the LEED certification team for the USGBC. Greg is coordinating RMI's research efforts for the RMI/CoreNet project. *Contact information: Tel: 303-449-5226; email: gfranta@rmi.org.*



Bill Browning, HAIA
Senior Fellow

Mr. Browning had key roles in creating both the U.S. Green Building Council and its LEED™ rating system, and is active on the USGBC Board and LEED committees. He is currently a Senior Fellow at Rocky Mountain Institute, a partner in a new green development consulting firm, Browning Partners LLC, also in Browning + Bannon LLC and formerly a principal in Haymount, a green new-town development in Virginia. Mr. Browning led the greening of the White House, and has consulted on more than 300 green development projects worldwide. Mr. Browning lectures extensively throughout the world. His books include *A Primer on Sustainable Building*, and the groundbreaking text *Green Development: Integrating Ecology and Real Estate*. He co-authored the influential *Greening the Building and the Bottom Line: Increasing Productivity through Energy-Efficient Design*, which presented a new economic case for green design in the workplace based on higher worker productivity, lower absenteeism, fewer errors, better quality, and increased sales. Bill is serving as an advisor to the RMI/CoreNet team. *Contact information: email: bill@browningplusbannon.com.*



Aalok Deshmukh
Sustainable Design Consultant

Aalok has experience using a variety of building simulation tools, including energy simulation and computational fluid dynamics tools. He has experience in building commissioning, retro-commissioning, energy auditing, building energy analysis, and sustainable consulting. He has a master's degree in building design with an emphasis in energy and climate from Arizona State University. He is a LEED Accredited Professional, a part of the LEED project certification review team for the



USGBC and a licensed architect in India. He has a keen interest in the development and application of appropriate technologies, standards, and rating systems as they pertain to energy use and the environmental impact of buildings—in both India and the developing world in general. Aalok is leading RMI's research efforts in identifying barriers to energy efficiency in corporate real estate and formulating strategies to overcome these barriers. *Contact information: Tel: 303-449-5226; email: ADeshmukh@rmi.org.*

Eric Maurer
Stanback Fellow – Duke University

After receiving an undergraduate degree in finance from Miami University, Eric spent three years working for the Investor Responsibility Research Center (IRRC). At IRRC, he assessed the social and environmental performance of US corporations for their inclusion in the FTSE4Good investment index. Following this experience, Eric began pursuing a Master of Environmental Management degree at Duke University. Prior to returning to Duke to complete his degree, Eric is applying his experience in survey design and implementation to a number of projects within RMI. Eric is providing research support and lending his expertise in survey design and implementation for the RMI/CoreNet project. *Contact information: Tel: 303-449-5226; e-mail: emaurer@rmi.org.*



Caroline Fluhrer
MAP Fellow – Stanford University

Caroline recently graduated from Stanford with an undergraduate degree in Civil Engineering and a Master's degree focused on Energy Engineering. As a graduate student, she served as a teaching assistant for Energy Efficient Building and Renewable Energy & Power courses. During her summers, she has spent time at structural engineering, construction, and civil engineering firms as well as studied abroad at Oxford University. At RMI, Caroline's work thus far has focused on factor-10 engineering, integrated design, and making the business case for green building. For the RMI/CoreNet project, Caroline is providing research support and technical expertise. *Contact information: Tel: 303-449-5226; e-mail: cfluhrer@rmi.org.*



APPENDIX D: PLATINUM & GOLD LEED PROJECT LIST

LEED New Construction							
Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Alberici Corporate Headquarters	Alberici Corporation	US	Plat.	110,000	8-Jul-05	Commercial Office	Profit
Artists for Humanity EpiCenter	Artists For Humanity	US	Plat.	23,500	13-Oct-05	Multi Use	Nonprofit
Audubon Center at Debs Park	Audubon Society	US	Plat.	5,000	11-Dec-03	Interpretive Center	Nonprofit
Center for Neighborhood Technology	Center for Neighborhood Technology	US	Plat.	13,800	22-Nov-05	Commercial Office	Nonprofit
CII-Sohrabji Godrej Green Business Centre	Confederation of Indian Industry	IN	Plat.	17,000	31-Oct-03	Commercial Office	Nonprofit
Donald Bren School of Env. Sci. & Management	University of California, Santa Barbara	US	Plat.	85,000	18-Apr-02	Higher Edu.	Other
Genzyme Center	Genzyme Corporation/ Lyme Properties	US	Plat.	350,000	23-Aug-05	Commercial Office	Profit
Gurgaon Development Center, Wipro Ltd	Wipro Technologies	IN	Plat.	120,000	12-Aug-05	Other	Profit
Hawaii Gateway Energy Center	Natural Energy Lab of Hawaii Authority (NELHA)	US	Plat.	5,600	12-Dec-05	Multi Use	State
Inland Empire Utilities Agency Administrative Headquarters	Inland Empire Utilities Agency	US	Plat.	33,000	31-Mar-04	Other	Other
ITC CENTRE PROJECT	ITC LIMITED	IN	Plat.	170,000	26-Oct-04	Multi Use	Profit
Lake View Terrace Branch of the L.A. Public Library	City of Los Angeles - L.A. Public Library	US	Plat.	10,700	18-Nov-05	Library	Local
Lewis and Clark State Office Building	Missouri Department of Natural Resources	US	Plat.	120,000	13-Mar-06	Commercial Office	State
NRDC So. California Office, Robert Redford Building	NRDC	US	Plat.	15,000	12-Nov-04	Commercial Office	Nonprofit

LEED New Construction							
Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Phillip Merrill Environmental Center	Chesapeake Bay Foundation	US	Plat.	30,600	30-Mar-00	Commercial Office	Nonprofit
The Chicago Center for Green Technology	City of Chicago Dept. of the Environment	US	Plat.	32,000	17-Jun-03	Multi Use	Local
Big-D Corporate Office Headquarters	Big-D Corporation	US	Gold	70,000	13-Mar-06	Commercial Office	Profit
Building 10	Honda R&D Americas, Inc.	US	Gold	15,100	20-Apr-06	Industrial	Profit
Calvin College Bunker Interpretive Center	Calvin College	US	Gold	5,270	10-May-05	Multi Use	Nonprofit
Cambria Office Building	PA Department of the Environment	US	Gold	36,000	03-Dec-01	Commercial Office	State
Cambridge City Hall Annex	City of Cambridge	US	Gold	32,000	1-Sep-05	Commercial Office	Local
Camp Aldersgate Commons	Camp Aldersgate	US	Gold	12,000	15-Jun-05	Multi Use	Nonprofit
Capitol Area East End Complex, Block 225	State of California Dept. of General Services	US	Gold	479,000	10-Jan-03	Commercial Office	State
Carkeek Park Environmental Learning Center	City of Seattle, Dept. of Parks & Recreation	US	Gold	1,700	03-Nov-03	Interpretive Center	Local
Carl T. Curtis Midwest Regional Headquarters Bldg	Noddle Development Company	US	Gold	68,000	5-May-05	Multi Use	Profit
Case Middle School, Punahou School	Punahou School	US	Gold	85,000	26-Jun-06	K-12 Education	Nonprofit
Cedar Water Treatment Facility	Seattle Public Utilities	US	Gold	5,600	31-Jan-06	Industrial	Local
Clean Water Services Administrative Offices	Clean Water Services	US	Gold	29,600	31-Aug-05	Commercial Office	Profit
Clearview Elementary School	Hanover Public School District	US	Gold	43,000	24-Mar-04	K-12 Education	Local
Colorado Court	Community Corporation of Santa Monica	US	Gold	30,200	6-Jan-05	Community	Profit
Conard Env. Research Area (CERA) Env. Education Center	Grinnell College	US	Gold	7,400	9-May-06	Higher Edu.	Other

LEED New Construction							
Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
David L. Lawrence Convention Center	Sports & Exhibition Authority	US	Gold	1,486,000	07-Nov-03	Assembly	Local
DEP California Office Building	MBC Properties	US	Gold	21,200	22-Jun-04	Commercial Office	Profit
DEP Southeast Regional Office Building	Vision Properties, LLC	US	Gold	111,700	30-Mar-05	Commercial Office	Profit
Doug and Darcy Orr Cottage	Warren Wilson College	US	Gold	6,800	29-Jun-06	Higher Edu.	Nonprofit
Douglas B. Gardner '83 Integrated Athletic Center	Haverford College	US	Gold	101,000	18-Apr-06	Higher Edu.	Other
Doyle Conservation Center	The Trustees of Reservations	US	Gold	14,100	26-Jun-06	Interpretive Center	Nonprofit
Edmonton Police Service - Southeast Division Station	City of Edmonton	Canada	Gold	48,944	18-Jan-06	Public order/safety	Local
Energy Efficiency Demonstration Project of Ministry of Sci. & Tech.	Ministry of Science and Technology	CN	Gold	139,000	19-Jul-05	Commercial Office	Federal
EPA Science and Technology Center	Kansas EPA Lab, LLC	US	Gold	72,100	04-Aug-03	Lab	Indiv.
Escalante Science Center	USDI, Bureau of Land Management	US	Gold	13,225	15-May-06	Multi Use	Federal
Far Southeast Austin EMS Station # 28	City of Austin	US	Gold		13-Jul-05	Public order/safety	Local
Ford Rouge Visitor Center	Ford Motor Company	US	Gold	31,200	05-Jun-03	Interpretive Center	Profit
French Wing Additon to Conservation Center	SPNHF	US	Gold	11,132	10-Mar-03	Commercial Office	Nonprofit
Frito-Lay Jim Rich Service Center	Frito-Lay, Inc.	US	Gold	40,900	17-May-05	Multi Use	Profit
George L. Stevens Senior Center	City of San Diego	US	Gold	11,000	26-Apr-06	Other	Local
GM Lansing Delta Township Assembly Plant	General Motors Corporation	US	Gold	1,500,000	30-Jun-06	Industrial	Nonprofit

LEED New Construction							
Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Green Operations Building	Corporation of the City of White Rock	CA	Gold	6,785	25-Jul-03	Industrial	Local
Grundfos Pumps India	Grundfos Pumps India Pvt Ltd.,	IN	Gold	25,000	10-May-05	Other	Other
Happy Feet Plus, Inc.	Happy Feet Plus	US	Gold	6,000	15-Oct-04	Retail	Profit
Hayward Building Systems Plant	Hayward Building Systems	US	Gold	43,000	28-Jan-04	Multi Use	Profit
Hensley Field Operations Center	City of Dallas	US	Gold	80,000	22-Nov-05	Multi Use	Local
Herman Miller C1 Main Site	Herman Miller, Inc.	US	Gold	19,076	18-Nov-02	Commercial Office	Profit
Herman N. Hipp Hall	Furman University	US	Gold	38,000	11-Jul-03	Multi Use	Other
Hewlett Foundation Headquarters	The William and Flora Hewlett Foundation	US	Gold	48,000	12-Sep-02	Commercial Office	Nonprofit
Hillsboro Civic Center	City of Hillsboro	US	Gold	108,030	3-Feb-06	Multi Use	Local
Hillsdale Library	Multnomah County	US	Gold	5,097	02-Nov-04	Library	Local
Institute of EcoTourism	Institute of EcoTourism	US	Gold	1,559	08-Jul-04	Interpretive Center	Nonprofit
IslandWood: A School in the Woods	Puget Sound Environmental Learning Center	US	Gold	55,000	24-Sep-02	Interpretive Center	Nonprofit
J. Richard Carnall Center, PFPC Worldwide Headquarters	PNC Financial Services Group	US	Gold	113,500	13-Jun-03	Commercial Office	Profit
Jane D'Aza House of Formation	Sisters of St. Dominic	US	Gold	6,200	31-Mar-06	Multi Use	Nonprofit
Jean Vollum Natural Capital Center	Ecotrust	US	Gold	70,000	12-Dec-01	Multi Use	Nonprofit
Joel and Linda Abromson Community Education Center	University of Southern Maine	US	Gold	32,000	22-Mar-06	Higher Edu.	Other
John R. Howard Hall	Lewis & Clark College	US	Gold	51,000	5-Dec-05	Higher Edu.	Profit
Kelley Engineering Center	Oregon State University	US	Gold	136,000	14-Jun-06	Higher Edu.	Other

LEED New Construction							
Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Life Sciences Center, University of British Columbia	The University of British Columbia	Canada	Gold	561,521	19-Dec-05	Multi Use	Other
Lowe's of S.W. Austin	Lowe's Home Centers Inc.	US	Gold	134,563	6-Mar-06	Retail	Profit
McGowan Institute for Regenerative Medicine	University of Pittsburgh	US	Gold	45,200	2-May-05	Lab	Other
Melink Corporation Headquarters	Melink Corporation	US	Gold	30,000	24-May	Multi Use	Profit
Michigan Alternative and Renewable Energy Center	City of Muskegon	US	Gold	26,990	30-Jun-05	Multi Use	Local
MidState Electric Cooperative Administration Building	MidState Electric Cooperative	US	Gold	13,303	3-Mar-06	Other	Nonprofit
Navy Federal Credit Union Remote Call Center	Navy Federal Credit Union	US	Gold	57,000	29-Jul-04	Commercial Office	Nonprofit
Navy's Energy & Sustainable Design Demonstration Facility	Naval Base Ventura County	US	Gold	17,000	3-Mar-05	Other	Federal
North Mall Office Building	State of Oregon, Dept. of Admin. Services	US	Gold	115,000	8-Dec-05	Multi Use	State
North Sarasota Public Library	Sarasota County Government	US	Gold	24,880	28-Jun-05	Library	Local
Nose Creek Recreation & Library Facility	Cit of Calgary	CA	Gold	193,000	2-May-05	Multi Use	Local
One Potomac Yard	Crescent Resources, LLC	US	Gold	323,995	19-Jun-06	Multi Use	Profit
PA DEP Bureau of Laboratories	Vartan Group Inc.	US	Gold	120,000	20-Apr-05	Lab	Profit
PA-DEP Moshannon District Office	MBC Properties	US	Gold	14,400	20-Apr-05	Commercial Office	Profit
Park 90/5 C	City of Seattle	US	Gold	172,000	25-Oct-04	Multi Use	Local
Pavilions Lassonde-École Polytechnique de Montréal	École Polytechnique de Montréal	CA	Gold	333,000	10-Oct-05	Higher Edu.	Nonprofit
Pennsylvania Housing Finance Agency	Pennsylvania Housing Finance Agency	US	Gold	100,000	27-Sep-05	Commercial Office	Profit

LEED New Construction							
Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Plantronics Factory	Plantronics	China	Gold	150,600	19-Apr-06	Industrial	Profit
Pleasanton Fire Station 4	Livermore-Pleasanton Fire Department	US	Gold	7,545	23-Dec-05	Public order/safety	Local
Presentation Center Dining Hall & Welcoming Center	Presentation Center	US	Gold	11,372	10-Mar-06	Multi Use	Nonprofit
Q Building Lab	Pharmacia	US	Gold	176,000	07-Feb-02	Lab	Profit
RAND Corporate Headquarters	RAND Corporate Headquarters	US	Gold	321,111	12-Jan-06	Commercial Office	Nonprofit
Regional Training & Distribution Center	American Honda	US	Gold	211,000	29-Aug-02	Industrial	Profit
Regional Training Center	WA Department of Corrections	US	Gold	10,372	27-Oct-05	Campus (Corp. or school)	State
Rinker Hall	University of Florida-Gainesville Campus	US	Gold	47,470	07-May-04	Higher Edu.	State
Royal Caribbean International Customer Contact Center	Royal Caribbean Cruises, Ltd.	US	Gold	168,453	17-Mar-06	Multi Use	Profit
S. T. Dana Building Renovation	The University of Michigan	US	Gold	107,803	6-May-05	Higher Edu.	State
Schlitz Audubon Nature Center	Schlitz Audubon Nature Center	US	Gold	20,000	12-Oct-04	Interpretive Center	Nonprofit
Seattle City Hall	The City of Seattle, Fleets & Facilities Dept.	US	Gold	202,000	26-Sep-05	Multi Use	Local
Seattle Terminal Radar Approach Control	Federal Aviation Administration	US	Gold	52,000	19-May-04	Other	Federal
Seminar II	The Evergreen State College	US	Gold	165,423	24-Feb-06	Higher Edu.	State
South Campus Office Development	Toyota Motor Sales	US	Gold	630,000	15-Apr-03	Commercial Office	Profit
Stoller Winery	Stoller Vineyards	US	Gold	23,000	17-Apr-06	Other	Profit
Sun Valley Branch of the Los Angeles Public Library	City of Los Angeles	US	Gold	12,500	11-Aug-05	Library	Local

LEED New Construction							
Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Suwannee River Visitor Center	Georgia Department of Natural Resources	US	Gold	14,000	29-Aug-05	Interpretive Center	State
The Arthur M. Blank Family Office	AMB Realty	US	Gold	98,462	14-Oct-04	Commercial Office	Indiv.
The Helena Apartment Building	The Durst Organization	US	Gold	602,021	1-Jun-06	Multi-Unit Residential	Profit
The Henry	Gerding/Edlen Dev. Company, LLC	US	Gold	211,700	1-Apr-05		Profit
Herman Miller MarketPlace - an intellisys bldg	Granger Group of Companies	US	Gold	100,000	24-Jan-03	Commercial Office	Profit
The Plaza at PPL Center	Liberty Property Trust	US	Gold	280,000	10-Mar-04	Commercial Office	Other
The Solaire/20 River Terrace	River Terrace Associates, LLC	US	Gold	386,000	13-Apr-04	Multi-Unit Residential	Profit
The Willow School Phase I	Willow School	US	Gold	13,866	08-Oct-04	K-12 Education	Profit
Third Creek Elementary School	Iredell-Statesville Schools	US	Gold	92,000	06-Nov-02	K-12 Education	Local
TKG Consulting Engineers, Inc. Oberlin Office	TKG Consulting Engineers, Inc.	US	Gold	18,420	12-Oct-04	Commercial Office	Profit
Toyota Portland Vehicle Distribution Center	Toyota Motor Sales, U.S.A., Inc.	US	Gold	68,600	24-May-05	Industrial	Profit
Tumwater Office Building	Tumwater Office Properties	US	Gold	220,000	10-Apr-06	Commercial Office	Profit
Twin Lakes Park Office Complex	Sarasota County Government	US	Gold	27,592	23-Sep-05	Commercial Office	Local
Two Potomac Yard	Crescent Resources, LLC	US	Gold	309,270	19-Jun-06	Multi Use	Profit
U.S. EPA, New England Regional Lab	iStar Financial for U.S. GSA, Region 1	US	Gold	66,233	02-Feb-03	Lab	Profit
University of Denver College of Law	University of Denver	US	Gold	210,000	12-Jun-05	Higher Edu.	Other

LEED New Construction

Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Vancouver Island Technology Park	BC Buildings Corporation	CA	Gold	171,750	04-Feb-02	Commercial Office	State
Washington Veterans Home, Skilled Nursing Facility	Washington Department of Veterans Affairs	US	Gold	171,775	7-Apr-06	Housing	State
Wind NRG Partners, LLC	NRG Systems, Inc.	US	Gold	46,000	1-Mar-05	Multi Use	Profit
Winnipeg Mountain Equipment Co-operative	Mountain Equipment Co-operative	CA	Gold	25,157	20-Dec-04	Retail	Other
Winrock International Headquarters	Winrock International	US	Gold	25,000	13-Jul-05	Commercial Office	Nonprofit
Wisconsin DNR - NE Regional Headquarters and Service Center	State of Wisconsin	US	Gold	34,560	8-May-06	Multi Use	State

LEED Existing Buildings

Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Adobe Systems Incorporated, West Tower	Adobe Systems Incorporated	US	Plat.	391,708	9-Jun-06	Commercial Office	Profit
California Department of Education Building	California Department of General Services	US	Plat.	421,150	28-Jun-06	Multi Use	State
Joe Serna Jr. – California EPA Headquarters Building	Thomas Properties	US	Plat.	950,000	1-Nov-03	Commercial Office	Local
200 Market Building	200 Market Associates Limited Partnership	US	Gold	388,191	14-Mar-06	Commercial Office	Profit
260 Townsend - Swinerton Headquarters	Swinerton Builders	US	Gold	66,945	12-Jul-04	Commercial Office	Profit
Alliance Center	Alliance for Sustainable Colorado	US	Gold	38,000	7-Jul-06	Commercial Office	Nonprofit
Brengel Technology Center	Johnson Controls, Inc.	US	Gold	130,000	25-May-04	Commercial Office	Profit

LEED Existing Buildings

Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Conservation Consultants Incorporated Center	Conservation Consultants, Inc.	US	Gold	11,500	30-Jun-05	Commercial Office	Nonprofit
Denver Place	Amerimar Realty Management Company	US	Gold	815,000	5-Nov-04	Multi Use	Profit
Goizueta Business School	Emory University	US	Gold	122,000	28-Feb-05	Commercial Office	Other
JohnsonDiversey Inc. Global Headquarters	JohnsonDiversey, Inc.	US	Gold	2,316,996	10-Aug-04		Profit
Karges-Faulconbridge, Inc. Headquarters	Karges-Faulconbridge, Inc. Headquarters	US	Gold	33,400	1-Nov-04	Commercial Office	Profit
King Street Center	King County	US	Gold	327,000	6-Apr-04	Multi Use	Local
Len Foote Hike Inn	Georgia Department of Natural Resources	US	Gold	6,000	5-Nov-04	Multi Use	State
Moss Landing Marine Laboratories	Moss Landing Marine Laboratories	US	Gold	60,000	24-Jun-04		Other
NEG Micon (India) Private Ltd.	NEG Micon	IN	Gold	17,750	9-Sep-05		Other
Nike, Inc. Ken Griffey Jr. Building	Nike, Inc.	US	Gold	95,189	12-Jul-05	Commercial Office	Profit
The Lubin manufacturing facility	Knoll, Inc.	US	Gold		29-Oct-04	Industrial	Profit

LEED Commercial Interiors

Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Interface Showroom Office	Interface Americas, Inc.	US	Plat.	486,993	23-Sep-04	Multi Use	Profit
AIA Honolulu Chapter Office	American Institute of Architects	US	Gold	1,676	30-Aug-04		Profit
Boulder Associates Office	Boulder Associates, Inc.	US	Gold	13,323	6-Oct-05	Commercial Office	Profit
Chong Partners Architecture	Chong Partners Architecture	US	Gold	43,254	12-Aug-04	Commercial Office	Profit

LEED Commercial Interiors							
Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Coro Center Terminal Building Tenant Space	Coro Center for Civic Leadership	US	Gold	10,326	5-Oct-04	Commercial Office	Nonprofit
DPR Office Interiors	DPR Construction, Inc.	US	Gold	11,600	11-Aug-04	Commercial Office	Profit
Haworth Chicago Showroom	Haworth	US	Gold	23,560	8-Jun-05	Retail	Profit
Haworth Santa Monica Showroom	Haworth	US	Gold	18,500	15-Mar-06	Retail	Profit
Herman Miller Design Yard Front Door	Herman Miller, Inc.	US	Gold	25,503	31-Oct-05	Commercial Office	Profit
Herman Miller National Design Center, Washington, DC	Herman Miller, Inc.	US	Gold	293,000	25-Jul-05	Other	Profit
HOK Canada + Urbana Architects Office	HOK Canada + Urbana Architects	Canada	Gold	24,795	3-Jan-06	Commercial Office	Profit
Kimball International Corporate Showroom	Kimball Office	US	Gold	35,000	30-Nov-05		Profit
Natural Resources Defense Council, San Francisco Office	Natural Resources Defense Council	US	Gold	15,530	9-Feb-05	Commercial Office	Nonprofit
Nusta Spa	Elizabeth Snowden	US	Gold	127,140	14-Mar-05	Multi Use	Indiv.
Omicron Office Tenant Improvement	Omicron AEC	Canada	Gold	15,400	3-Jan-06	Commercial Office	Profit
REI Portland	Recreational Equipment, Inc. (REI)	US	Gold	37,448	30-Sep-04	Retail	Profit
SCA Americas Headquarters	SCA Americas	US	Gold	75,000	21-Apr-06	Commercial Office	Profit
SERA Architects Offices	SERA Architects	US	Gold	10,000	18-Apr-06	Commercial Office	Profit
Starbucks 1st & Main	Starbucks Coffee Company	US	Gold	1,686	17-Apr-06	Multi Use	Other
SUGEN, Inc. Building 3	SUGEN, Inc.	US	Gold	67,674	25-Aug-04	Lab	Profit
Vancouver Port Authority Offices	Vancouver Port Authority	Canada	Gold	55,000	21-Feb-06		Federal

LEED Commercial Interiors

Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
Wells Fargo Bank- Pearl District Branch	Wells Fargo	US	Gold	2,700	25-Jan-06	Multi Use	Profit
West Michigan Environmental Action Council	West Michigan Environmental Action Council	US	Gold	7,200	6-Jul-06	Commercial Office	Nonprofit
Wetland Studies and Solutions, Inc.	Wetland Studies and Solutions, Inc.	US	Gold	53,614	2-Mar-06	Commercial Office	Profit
WRT - Philadelphia Office	Wallace Roberts & Todd, LLC	US	Gold	24,000	2-Feb-05	Commercial Office	Profit

LEED Core & Shell

Project Name	Owner	Country	Rating	Sq.Ft.	Cert. Date	Project type	Owner Type
111 South Wacker Drive	The John Buck Company	US	Gold	1,400,000	13-Oct-05	Commercial Office	Profit
1180 Peachtree at Symphony Center	NOP 1180 Peachtree LLC	US	Gold	792,209	14-Oct-05	Multi Use	Profit
318 Sentinel Drive	Corporate Office Properties Trust	US	Gold	125,000	25-Oct-05	Commercial Office	Profit
7 World Trade Center	Silverstein Properties	USA	Gold		7-Mar-06		
Collaborative Innovation Center at Carnegie Mellon	Regional Industrial Development Corporation of Southwestern Pennsylvania	USA	Gold	136,000	5-Dec-05	Campus (Corp. or school)	Profit
East Hills Center	East Hills Center LLC	USA	Gold	7,200	3-Feb-06	Multi Use	Profit
The Restaurant at Abercorn Common	Melaver, Inc	USA	Gold	4,700	8-Jun-06	Restaurant	Profit

APPENDIX E: LITERATURE REVIEW

The following 20 barriers (in no particular order) originate from the articles summarized below. While not exhaustive, the listed barriers represent many of the major impediments to incorporating energy efficiency measures – *please comment on their relevance and importance (perhaps even rank them?) as barriers to energy efficiency investments in corporate real estate.*

- a) Higher first cost myth
- b) Failure to apply life-cycle metrics
- c) Cost of full information is prohibitive
- d) No capitalization of energy efficiency into market value
- e) Competing capital investments and/or access to capital
- f) Perceived project risk determines discount rates
- g) Energy costs are a small fraction of operating expenses
- h) Investment decisions are affected by market strength
- i) Supply chain participants are not compensated based on building performance
- j) Buildings are not metered appropriately to align tenant/landlord incentives
- k) Lack of widespread market demand for energy efficient buildings
- l) It is easier to maintain the status quo than to incorporate innovative design measures
- m) Designers are typically not involved in initial, yet crucial, design decisions
- n) Building codes and regulations reinforce current practice and technologies
- o) Risk-averse, uninformed, or powerless decision makers
- p) Perception that energy code creates energy-efficient buildings
- q) Fragmentation and urgency of building design and construction process
- r) Numerous technical languages inhibit communication amongst key players
- s) Building managers are not given the proper tools or training to optimize building performance
- t) Benefits of energy efficiency are uncertain and not easily quantifiable

ARTICLE SUMMARIES

As stated in a December 1992 report on energy efficiency by Amory Lovins, “It is inconceivable that in a market economy, such large and profitable savings would remain untapped. But to a practitioner who knows how buildings are created and run, it is not only conceivable but obvious.” The following short paragraphs summarize articles that discuss previously identified barriers to realizing greater energy efficiency in commercial office spaces and warehouses. It is intended that this in-progress research, plus the upcoming charrette discussions, will form the basis for developing the survey content.

Russell, C. (2003). *Motivating Business Leaders to Improve Profitability through Energy Efficiency*. Alliance to Save Energy. (USA)

Co-sponsored by the New York State Energy Research and Development Authority and the U.S. Department of Energy, this report investigates corporate receptiveness to energy

efficiency. The report is based on the premise that, "The same investments and practices that enable energy efficiency also often improve productivity, plant reliability, emissions compliance, and workplace safety." The purpose of the project is to develop strategies that will facilitate motivation of New York business leaders to "improve business performance through energy efficiency." The report concludes that there are eight different rationales that typically make energy efficiency projects less appealing to decision-makers including: 1) lacks organizational stability, 2) investment bias for core business, 3) fixation on energy price rather than expense, 4) lacks technical appreciation, 5) defers to production/business climate risks, 6) jaded by energy "snake oil" from the past, 7) conservative capital investment criteria, and 8) sensitive to fuel price/tariff risk. Furthermore, each hurdle is matched with a "solution" or method for encouraging a company with that particular mentality to proceed with an energy efficiency project. For example, a segment 4 company that lacks technical appreciation needs to be shown more case studies and data. Lastly, the report notes that, "Any overture to the business community regarding energy efficiency requires a vision that speaks primarily to business interests more so than energy-efficiency goals."

Jones, D.W., Bjornstad, D.J., Greer, L.A. (2002). Making Energy-Efficiency and Productivity Investments in Commercial Buildings: A Choice of Investment Models. Environmental Sciences Division, Oak Ridge National Laboratory. (USA)

This report, prepared for the U.S. Department of Energy by the Oak Ridge National Laboratory, investigates what information and tools are employed when making commercial building investment decisions. A major motivation for the report is to understand why commercial building investors consistently choose first-cost over life-cycle analyses – a major barrier to implementing energy efficiency projects. Factors that affect building energy investments include logistical circumstances (timing, staff availability and knowledge, etc.), scale of investment (small or big), market conditions, status of entire building portfolio, implicit discount rate, degree of capitalization of assets (are productivity or lower operating costs included in rental prices?), and value and time horizon of options that may reduce uncertainties. Investment criteria used in making building energy investments include the payback period, the internal rate of return, and the cost/benefit analysis. The report concludes that reducing uncertainty in any informational hole (such as technological performance or market capitalization) reduces the option cost of an immediate investment, thereby reducing the hurdle rate for the investment. Thus, generating data on how much individual technologies or efficiency upgrades contribute to the profits of the buildings' users and owners is critical to reducing hurdle rates for investment.

Cavanagh, R. (2004). Energy Efficiency in Buildings and Equipment: Remedies for Pervasive Market Failures. National Commission on Energy Policy. (USA)

This short article, prepared for the National Commission on Energy Policy, contends that "pervasive market imperfections" have led to systematic underinvestment in energy efficiency measures. Market failure is understood as "distorted energy prices and/or a gap between the private discount rate that households and businesses apply to energy-efficiency investment decisions and the social discount rate." Cavanagh states that energy consumers are demanding annual rates of return of 40-100% for energy efficiency projects. Additional barriers include discrepancies between decision makers and bill payers, landlords and

tenants, and designers and their contract structures.

Sustainable Energy Policy Concepts. (2004). Instruments for a Sustainable Energy Policy in Germany: Context and Barriers to Energy Efficiency. (Germany)

This qualitative short article on energy efficiency is part of a larger project that examines instruments for a sustainable energy policy in Germany. Funded by the German Federal Ministry for the Environment, this article discusses six main barriers to implementing energy efficient and demand-side management measures. These barriers include 1) a lack of information on the part of consumers, vendors, manufacturers and policy makers, 2) institutional and legal barriers, 3) financial barriers, 4) technological barriers and infrastructure, 5) energy prices and rate making, and 6) diversity of actors and expectations. One unique barrier discusses how legal accounting procedures may impede utilities from considering investments in their customers' facilities as part of the utility investment. Another section highlights how energy efficiency may not be a high priority investment – “an industrial customer may prefer to spend capital on a new line of products rather than consider a retrofit in existing installations.” They also state, “Many new and efficient technologies incorporate electric components that rely on good quality power to operate. Voltage fluctuations and frequent power failures will shorten the equipment’s designed lifetime.” And lastly they authors, “The evaluation of the economic attractiveness and the convenience (or inconvenience) of implementing a given measure depends on the perspective and criteria of each agent.”

Lovins, A.B. (1992). Energy-Efficient Buildings: Institutional Barriers and Opportunities. E Source. (USA)

In this comprehensive paper, the topic of institutional barriers to achieving greater energy efficiency in commercial buildings is discussed in detail. Lovins argues that “Buildings are rarely built to use energy efficiently, despite the costs that inefficient designs impose on building owners, occupants, and the utility companies that serve them.” The rationale behind this “market failure” originates within and amongst the fragmented sectors of the building supply chain. Pertinent barriers within each area of the supply chain are outlined below:

Financial barriers:

- Developers are more concerned with minimizing capital cost per square foot of net marketable floorspace, than with maximizing the building’s long-term financial performance. Similarly, brokers, mortgage bankers, and investment advisors are rewarded based on the original project value, not on the building’s long-term financial performance.
- The additional value of energy-efficient commercial buildings is rarely reflected in the appraisal process, security ratings, or market value. Emphasis is often solely placed on market conditions, aesthetics, and location – low operating costs or innovative technologies are rarely highlighted.
- The concept that capital cost can be reduced through thoughtfully designed building systems seems far-fetched.

- There is rarely a local average energy bill against which to compare your building's bill due to relatively few commercial-sector "truth-in-renting" energy-disclosure rules.
- "Many commercial leases, too, are still written on a 'gross' basis (i.e., they include energy and other operating costs in a total rent figure), giving the tenant no incentive to save even though the landlord could in principle keep the saving. 'Net' leases reverse this problem to the extent that energy cost components, typically for lights and plug loads but sometimes also for space-conditioning, are individually metered and billed. Neither lease form, as conventionally written, gives *both* parties an appropriate incentive to save."

Design-related barriers:

- To avoid liability, designers often roundup equipment sizes or rely on advice from manufacturers creating ridiculous safety margins (as great as tenfold) – often without performing models to verify performance
- Furthermore, percentage-of-cost contracts reward oversizing of equipment. "Designers who do extra work to design and size innovative HVAC systems exactly right, thereby cutting their clients' capital and operating costs, are directly penalized by lower fees and profits as a result, in two different ways: they are getting the same percentage of a smaller cost, *and* they are doing more work for that smaller fee, hence incurring higher costs and retaining less profit."
- A single entity rarely takes responsibility for ensuring designers communicate to create an integrated design – different fee structures, perspectives, and technical languages further inhibit interaction.
- Most architects lack the time and knowledge to check the engineers' work for maximum energy efficiency.
- Mechanical designers are brought on too late in the project, when the most critical decisions have already been made.
- Time-pressed superiors, as well as code officials, would rather approve safe and familiar designs. "The U.S. Office of Technology Assessment summarizes: It is usually easier for the designer to follow accepted, standard practice, especially if the designer's fee is the same in either case. As one interviewee said, 'The path of least resistance does not include energy innovative design.'"
- Price competition between engineers encourages fast and easy "catalog engineering," which is hardly engineering, but "only the application of crude and outmoded rules-of-thumb to selecting common listings from major vendors' catalogs. *This procedure is at the root of today's appallingly low mechanical-system efficiencies.*"

Construction-related barriers:

- Equipment availability sometimes dictates selection – whatever "equivalent" (usually in terms of capacity, not energy efficiency) pump or duct is handy may be installed.
- Suppliers can be reluctant to sell new products – for example, "people who use imaging specular reflectors buy only half as many fluorescent lamps to go under them, so vendors may discourage competing products that save customers' dollars and energy at the expense of their own sales."
- The commissioning team is rarely rewarded for the initial building performance or for how well the building operators understand the building systems.

O&M-related barriers:

- Building operators are usually poorly trained and tend to disable equipment or features they don't understand. Also, monitoring equipment is rarely installed, thus creating a

barrier to measuring actual building performance against intended building performance or warranty-related specifications. Furthermore, confusing building interfaces make it difficult for operators to understand, let alone optimize building performance.

- Building operators may never even see meter readings or utility bills
- Tenants are seldom given instructions as to how they can positively influence building performance
- Commercial building operators are mostly concerned with occupant comfort and minimizing complaints.
- There is little feedback to real-estate developers regarding occupant satisfaction – “The building industry is in this sense quite primitive: we would not dream of running a manufacturing business with so little and oblique contact with our customers, and if we tried to, we’d soon be out of business. But that is what the building industry tries to do with its complete disjunction of design, manufacturing, marketing, sales, delivery, repair, and renovation or demolition.”

Tenant-related barriers:

- Few commercial tenants are familiar with energy efficiency. “Notable exceptions exist: in Sydney, Australia, it has become fashionable to compete on how efficient and ‘smart’ one’s office building is, and many tenants ask penetrating questions about details of design and efficiency down to the component level.”
- There are many misunderstandings regarding energy efficiency; retail managers treat energy bills as “immutable as death and taxes.” Furthermore, “A survey of small businesses found that energy efficiency was thought to require turning down heat or turning off lights.”

Lutzenhiser, L., Biggart, N., 2003. Market Structure and Energy Efficiency: The Case of New Commercial Buildings (USA).

The article examines both the actors involved in the new construction process as well as in the real estate development process. The authors pay specific attention to the interactions between market participants, and they gather much of their data from semi-structured interviews conducted with key supply chain actors from a variety of large West-coast entities.

Traditional analyses of energy efficiency investments generally rely on two assumptions. First, the energy efficiency problem is viewed as one centered around design. Second, traditional analyses view market actors as possessing a great deal of autonomy. However, as decisions are made by the financiers and developers upstream, the downstream agents become increasingly constrained, further limiting their ability to add innovative items to a building. The incorporation of energy efficiency investments runs into additional problems as it is also considered a low priority building feature by most market actors. The authors note that energy efficiency measures are generally incorporated not for their energy saving capacity, but for other reasons entirely. Often these measures are picked up as a result of other design elements.

Similar to many other building amenities, the degree to which energy efficiency investments are incorporated in new buildings is often affected by the state of the market. During a market boom, energy efficiency investments are more likely to be incorporated into a

building because there is excess market demand. However, regardless of the state of the market, many real estate professionals view innovations as costly, increasing interest rates and equity requirements. Thus, most risk-averse real estate investors tend to view efficiency investments with skepticism. A variety of widely held perceptions common to many actors in the real estate supply chain further limits the adoption of energy efficiency measures. Many participants believe that simply meeting the energy code, creates an energy efficient building. Furthermore, there is a perception that the incorporation of one or a variety of energy efficient measures will create an energy efficient building. Lastly, whether one energy efficiency measure is installed or a variety of measures are installed, sometimes energy efficiency is incorporated in the building simply to offset less energy efficient features.

To further shed light on the adoption rates of energy efficiency measures, the authors describe four attributes that facilitate the incorporation of an innovation. An innovation should have an apparent relative advantage, be compatible with current conditions, be easily comprehensible, and facilitate an easy cost-benefit analysis. Energy efficient investments typically lack visibility, and it is often difficult to measure benefits. While the authors remain skeptical about the adoption of energy efficiency investments for their own sake, they do posit hope that these measures may be adopted as a component of another innovation (e.g., green building, better workplace, etc.).

Jones, D., Bjornstad, D., Greer, L., 2002. Measurement Issues for Energy Efficient Commercial Buildings: Productivity and Performance. (USA)

The authors describe the range of benefits that can accrue from buildings that incorporate energy efficient design strategies. Most often, energy efficiency practices are discussed in the context of their energy and cost savings potential; however, important productivity benefits may also accrue from incorporating measures like occupant thermal comfort and daylighting. While productivity benefits may provide substantial incentive to incorporate energy efficiency measures, there is little empirical evidence that productivity benefits are the direct result of energy efficiency improvements. Most of the evidence supporting this assertion tends to be anecdotal. The authors propose a methodology to statistically analyze the impact of certain energy efficiency measures on productivity. In addition to developing a method to link energy efficiency to productivity, the authors also describe the uncertainty, both technological and market-based, surrounding efficiency measures. These uncertainties drive the hurdle rate (the measure often used to evaluate the feasibility of a project), to levels that prevent the adoption of energy efficiency measures. The authors note that a survey of potential commercial building owners would be useful to determine the perceived uncertainties surrounding new building technologies. Such survey data may provide equipment designers with useful information for making design tradeoffs and may also pinpoint specific operational aspects in need of field-testing.

Kulakowski, 1999. Large Organizations' Investments in Energy-Efficient Building Retrofits. (USA)

To elaborate on how energy efficiency retrofits are performed within an organization's building stock, Kulakowski performed two case studies in California. The case studies revealed that an organization's facilities department generally makes energy efficiency retrofit decisions. Moreover, energy efficiency retrofits are funded from the facilities department's

budget, and these investments are viewed as expenses, rather than as investments evaluated in conjunction with other capital investments. In some cases, energy efficiency retrofits undergo more extensive analysis than other capital improvements like new carpet installation. Kulakowski also found that the financial analysis used to evaluate retrofits was often performed incorrectly.

APPENDIX F: ROUGH MEETING NOTES – 8/1/06

Introductory Presentation – GF

- See attached presentation

Supply-Chain Participant Discussion

- Suppliers of energy efficiency equipment and materials are not experiencing pull in the marketplace
- Finance department is focused on return on investment, but these participants need to be educated about down cycle benefits, e.g., greenhouse gas reductions
- Energy efficiency investments may also create a more comfortable and enjoyable work experience; these investments may become an important employee retention tool
- The focus on short-term orientation in US relative to the long-term outlook demonstrated by many European companies may affect energy efficiency adoption
- In the UK there has been a shift from using a long-term lease structure (15+ years) to a more short term lease structure (5-10 years)
- Focus on projects with short-term paybacks, which may override lease life anyway
- Measurement tends to be more common in Europe than the US
- Sustainability drives demand for energy efficiency in Europe; in the US, demand is fueled by financial drivers
- Difficult to attach financial metrics to some environmental benefits that arise from incorporating energy efficiency, e.g., how do we put a number on enhanced carbon trading position or better energy security
- Local, state, regional, and federal governments may push energy efficiency adoption
=> In the UK, a new regulation is requiring buildings to display their energy efficiency ratings much like the EnergyGuide labels that US retailers must display on large appliances
- Corporate procurement staff have an increasingly important role to play in the purchase of real estate services
- The need to educate corporate decision makers about energy efficiency measures tends to slow the process down
- Strategic planning groups may impact lease term decisions
- Building manager may mean different things in different organizations; in one organization, the building manager may be a “wrench turner”, while in another organization, an administrator
- Information systems restrictions may make it difficult to install energy monitoring software on computer systems
- The words “barrier” and “hurdle” may each mean something different in the context of adopting energy efficiency measures
- Information technology personnel create data rooms that are energy intensive; these personnel are skeptical of continuous energy use measurement
- Increasing information technology usage and higher density of use creates increased energy demands
- Companies seek flexibility because of changing supply chain composition, these companies pursue shorter term leases; compounding this short term perspective,

buildings are increasingly flipped to a situation of institutional ownership rather than the developer as owner

- Outsourcing distribution to 3pls, functional outsourcing is an issue =>rent space and manpower, additionally, many companies are now outsourcing their manufacturing function
- Investment community doesn't recognize energy efficiency at all, gross rents adjusted for office expenses may acknowledge energy efficiency issues to a limited expense
- Can't go outside ranges of tenant comfort level
- Multi-purpose developments experience different energy demands (e.g., necessary to light parking lots for extended period); if a multi-use development has one meter, one tenant can set the peak demand and detrimentally affect other tenants energy costs
- Business units can be a barrier or enabler: one participant saw the barriers to energy efficiency concentrated at the corporate level; however, another participant noted that business units are definitely a barrier – e.g. a corporation wants to green its business, but the business unit focuses on first costs rather than life cycle costs
- How do personal financial incentives and principal-agent problems play into the making or maintenance of a barrier to energy efficiency?
- It is important to separate corporate vision and direction from those actually implementing the corporate vision

Barriers Discussion

- Timely access to information is key – often times, no one analyzes the energy bills, and in some instances where sub-metering is available, the metering data may be provided, but with a significant lag time
- Lack of a clearly stated goal by businesses
- Energy use monitoring will allow you to determine the baseline energy efficiency of your building
- Premium cost of renovations vs. designing and constructing it right the first time
- When do you retire an asset – this is a sunk costs issue
- Incorporating energy efficiency measures is an uphill battle against standard systems currently employed by designers and contractors
- Many firms only invest in energy efficiency when there is a very short payback (e.g., less than three years) - there is also preference given to investments in a company's core business. Further limiting energy efficiency adoption, these investments are often analyzed using huge discount rates, and most analyses are not able to account for all the benefits that will be realized (e.g., reduced O&M)
- Operating budgets – same year (neutral) vs. capital budgets (fixed)
- Tenants see expense, but building owners don't – pass through expense
- Measure the expense vs. the utilization, pass through is recorded in GL as an expense
- Predictability is comforting to many tenants; thus, flat fee pricing is attractive
- On the O&M side, maintenance contracts are generally very prescriptive. These contracts typically focus on simply making sure equipment is running, rather than trying to incorporate new best practices, even if these best practices are simple to achieve. If best practices were supplied to the operating manager, they could be incorporated at very little expense. A great deal of O&M is outsourced, and there is significant room to make these out contracts more outcome oriented
- Product schedule duration: projects happen so fast that no one has enough time; time pressure is becoming an even more important driver. Companies see lost time in the

context of missed sales and revenues; In many cases, staff is already hired to show up on Day 1, so there is tremendous cost associated with delivering a building late

- Lack of anecdotal information: at certain times the general knowledge base has been a barrier, while at other times it has been an enabler
- The need to take expensive retrofits higher up the chain of command creates a demand for increased information, which creates a time lag on investments
- Culture of corporation, "make sure it can be done in our environment." Even if evidence exists that a technology has been successfully used in other environments, there is still substantial doubt that it will produce the same outcome in one's own company
- For big capital recommendations you want all of your bases covered. The big word is RISK, how do you cover your risk, and how do you convince all the people that must be involved in the investment that it will work and that they will not lose their jobs or credibility
- There needs to be a linkage between visionaries (top), architects (middle), and "wrench turners" (bottom)
- Complexity of market (many different vendors providing slightly different information) and speed of change in technology creates a situation where decision makers want to delay decisions
- Six sigma is generally focused on one-off investments and does not have a big project budget for starting a major investment program
- There is little in-house expertise about managing energy and seeking best practices. Additionally, energy managers tend to be reactive
- From the owner perspective, how do you integrate all the proposals into a management process across the whole business?
- Rate escalation places overemphasis on how to reduce energy costs. Decision makers are looking for the ability to control rates, and emphasis is being put on the procurement of power, rather than a focus on a holistic program that reduces consumption
- Johnson Controls tries to get to the highest management level where it all comes together so you don't have to deal with a variety of different goals
- Policy makers are key because they filter the CEO mission down to the rest of the organization
- Understanding the incentives of all the players involved is important
- There is a notion that energy efficiency measures don't apply to me
- Emphasis on sustainability in US is growing, especially for international companies
- Some voluntary measures are actually driving green buildings and practices
- Regulation doesn't play a role
- Experience level of team players makes a huge difference in design
- Pressure on increasing or decreasing energy efficiency based on each of the specialist's desires (see list in Lovins, 1992, p. 15); plus there are so many different interests. We can begin to overcome these issues through integrated design.
- Safety margin is incorporated from each participant, over-design ends up being major – how do you streamline the design process and grapple with perceived risk and incentive to over-design
- Level of tenant interest in energy efficiency is all over the map
- Default parameter is always to the lowest cost option, "we can't afford to pursue energy efficiency"

- Chief engineers plays a huge role in what lighting systems and what HVAC system is chosen, and if they have no guiding light then they typically choose the cheapest option
- Energy can sometimes be a profit center (more for lessors)
- Some companies want the sub-metering and don't want the flat price, others just want the certainty of a flat rate
- Strong disincentive for energy efficiency in some markets
- First cost myth is beginning to shift
- Lessees have minimal opportunity to impact lighting, etc.
- If you are leasing then it comes down to what features are available, and your ability to deviate from lighting features or sub-metering
- Life cycle analysis takes time and money up front; schedules don't allow for this kind of assessment, so it comes down to first costs
- Costs are typically analyzed component by component, rather than from a systems perspective
- Fees in design/construction haven't responded to integrated design concepts, everyone still thinks that LEED buildings are more expensive – follows a what is cost rather than what is benefit theme
- Despite data disproving first cost myth, there is still perceived risk of how can this happen in "my" case – can we set up a structure which would guarantee there is no risk? Perhaps minimize risk by CEO talking to CEO and picking the right team. There is a process that will minimize risk and increase chance of success, but it is not an easy task
- Setting quantifiable goals publicly creates a sense of accountability and quickly sets all kinds of action into motion
- Construction manager's goal is to get the project done on time
- Goldman Sachs identified a 5-7 percent value increase for sustainability performers, investors understand the benefits of sustainable companies
- If lending and insurance industries could recognize that sustainable measures reduce risk than this would facilitate the incorporation of energy efficiency
- Incentives create shift in markets and increase affordability in energy efficiency measures
- Telecommuters create a demand for unoccupied space in the office. Additionally, the energy that telecommuters use while they are at home is not captured by metering

Case Study Discussion

- Participant described a case where their company's public affairs office in Washington, D.C. requested the best building within a defined block, the participant focused on how they could create a lease to improve upon the space, are there similar examples of a more sustainable RFP or lease
- Each case should highlight specific barriers and describe how they were overcome
- One or more cases may make an internal comparison within a company between where they were able to incorporate energy efficiency and where they were not
- What is the trigger to open a dialogue about energy efficiency? What does it take to get the decision makers' attention? Are decision makers reactionary or are they progressive (e.g., CEO of UTC forced into sustainability, but now approaching it progressively)
- Can we incorporate the DJSI in any of these cases?
- It may be informative to showcase studies of things that didn't work

- Is there a place for a basic green renovation example
- Publishing survey results and case studies in magazines read by CEOs may put pressure on those CEOs not investing in energy efficiency
- A tenant space certified with LEED CI may be informative
- Case studies should focus on the office environment, but it may be worthwhile to highlight a warehouse facility, particularly because there are only a few warehouse case studies available (Patagonia, Verifone, Anixter Wire & Cable)
- In the Beijing Fun Tai district a huge mixed-use development is seeking to become a LEED showcase. In China, scarcity around energy availability is a major issue, and in new construction projects energy efficiency is mandated
- India platinum is the bottom – three platinum office buildings
- While not included in the case study portion, the report will include projects under development to demonstrate momentum
- What caused Wal-Mart to embrace sustainability?
- Johnson Controls headquarters example
- Interview candidates: Ray Anderson, H. Lee Scott, Mark Nichols, Kevin Oaks, GE CEO
- Toyota south campus, DC office (no real data, though), working on stuff in the enabler factory, Portland example – vehicle processing center, mainly paperwork and QC and ship them, something that mundane you can do a project makes it really a compelling case, shows adaptability and ease of application
- SC Johnson basic green example part of president's initiative in early 90's; led from the top and brought in Bill, lots of data, got LEED EB, well documented
- Highlight importance of natural lighting in call center in Phoenix designed by HOK
- Standardized RFP – Chicago example

Enablers Discussion

- When making retrofit decisions it is important to recognize where a building is in its life cycle
- Data on comparative costs of already existing efficient buildings (e.g., Davis/Langdon or Katz study)
- Life cycle cost data not historically used in the analysis, but Toyota is beginning to look at LCC in existing buildings. LCC is still not really done well; How detailed do you look? The level of difficulty has kept many from diving into it
- Tax credits are sometimes the only way to get the necessary ROI for a project; however, the problem is that the window for applying for incentives is often short for projects. Standards are pretty onerous, it may be tough to qualify, and the costs associated with acquiring the necessary information may be too high. If timing is out of sync, your window of opportunity is very short for applying and receiving the incentive.
- In the leasing world, how do you separate energy costs from the rest of the building costs and make it visible to the right people. Using energy star could play a role here.
=> Ability to sub-meter and purchase own power
- Conventional LCC tools aren't used enough
- Provide the right people with the right tools that are easily accessible. For example, make it easy for the Chief Engineer to understand and use energy modeling tools.
- Still a question of if institutional investors will pay for energy efficiency measures. If they are just buying NOI its tough to convince the Wall Street people, but on the other hand, it is pure cash so maybe this is good.

- Can you find a tenant interested, further down the line, in utilizing the space that you've improved with energy efficiency measures
- Several green REITS now exist – 100 million range
- Ability to monetize the value of an energy efficiency investment. In this scenario, you allow an external firm that specializes in valuing these investments to monetize future benefits – this is a way to “shift the risk”
- Early adopters will have to try and evaluate the benefits and provide a track record of operating costs so the appraiser can provide an appropriate value
- LEED may not be the way to go to push energy efficiency because LEED certified does not necessarily guarantee energy efficiency
- What if the building manager lets the building go, even if it is LEED certified it may not be in good shape
- Some utilities/state agencies will pay for energy modeling, providing the right people with a list of these resources would be helpful
- Charrette process becoming more and more common
- Performance based architectural fees, addendum to AIA contracts, also want that to apply to the contractor
- Bring in MEP early in design; get CEO informed enough to invest in getting the MEP there early
- Prior to using something like LEED, it is important to do a goal setting exercise to see what you are trying to accomplish
- Create a standard process for analyzing and selling energy efficiency measures (some level of customization is required) and distribute it to the decision makers to show them that creating a new project is not really all that difficult. Show this process to a broad spectrum then you don't have to reinvent the process each time
- Expedited approvals for environmentally efficient design, this doesn't cost municipalities much money
- Streamline paperwork process, trend in market is utilizing building information modeling (BIM), a 3-D model (Autodesk is marketing an off the shelf model), which allows you to spend more time upfront because the documentation is already done.
- Bonuses and incentives according to meeting environmental metrics that everyone can follow
- Ability to analyze energy history before lease is signed
- Johnson Controls has a facility assessment program where they analyze the clients proposed space before move in. Any identified problems are rolled into the Tenant Improvements (TIs) to increase the allowance. Johnson Controls will also help the tenant write the RFP. The space audit looks for obvious problems with energy efficiency to make sure the building systems are operating appropriately
- Tenant guidelines/user's manual, occupant's manual for everyone
- Data on productivity or retentions issues
- Ability to “walk the talk”
- Financial side: Allow the finance department to develop a financial model, use that model for every energy investment analyzed. This translates energy efficiency into their language
- One participant noted that in every case where they've seen improvements made, the organization making the improvements has always embraced a bigger goal
- Documenting statements by CEOs may be a valuable exercise. For example, why is it that particular companies signed up for EPA Climate Leaders? Disclose this information in articles in CEO magazines, and let competition drive other companies to

incorporate energy efficiency. Many CEOs don't want to be low hanging fruit in terms of regulatory pressure

- Comprehensive O&M training, turnover of O&M employees is usually pretty high, so video tape the O&M training, and show new employees a DVD of previous training sessions
- Important to do seasonal testing, rather than just testing during one season
- Make sure the "wrench turners" understand the concepts behind what it is they are doing
- Do you make up for the commissioner's fee in other areas?
- Use of buildings changes over time and nobody readjusts the building for operating efficiency according to its new use
- Toyota uses a "Treasure Hunt" to drive improvement. This activity involves sending "wrench turners" out to another facility to find bugs in a facility. The hunt starts on a Sunday when nothing is running and then continues as the place comes to life. The last day of the site visit is spent assessing what needs to be done and how to implement these alterations. Toyota has seen that as "wrench turners" go off site to assess other factories, they typically return to their job site and make similar fixes. To do this effectively, business-unit "buy in" is important. Incremental training is acquired as the participants identify new issues
- A 1 percent reduction in energy usage can actually mean an avoidance of a 3 percent increase in energy usage
- PR value to doing some of these things, may be able to assign a monetary value to the media placement a company receives from adopting energy efficiency measures
- Providing benchmarking data, companies self-report information on an anonymous basis and can have access to that database
- Internal data collection to assess internal energy efficiency improvements
- Data that tells executives where they stand relative to their competitors is compelling
- Give buildings a score relative to each other, so people don't want to have the low ranked building
- Benchmarking could provide a way to prioritize investments, this is separate from giving people scores; benchmarking would help in decision making for those first timers who haven't collected data, etc., quantify the potential; in benchmarking you may miss the opportunities to replace, how do you capture the replacement cycle with overlapping of benchmarking? System allows you to see where you are and match it up with the replacement cycle as far as what you want to implement when things come to cycle
- Build in opportunities to benchmarking
- Legislative enablers... e.g., building energy use labels
- Could class A gravitate toward energy efficiency, is there a class A-Energy, developers landlords and brokers who want marketing edge could do some kind of internal audit to put in a brochure about space as marketing edge, pre due-diligence
- Comprehensive electronic manual for systems, cut sheets, drawings and specs, recommissioning manual, vendor, etc.

Survey Process

Following the creation of the survey, it will be tested with a small group to determine the necessary amount of time required and to verify that choices provided are appropriate and

comprehensive. We expect the survey to take between ten to fifteen minutes. Roughly speaking, it will cover what's being done (current practices) and include some open-ended questions. With the right sample audience, we expect a 60-70 percent response rate. To communicate back to respondents, we typically have several conference call debriefings to share the survey results in a relatively raw manner.

APPENDIX G: INTRODUCTORY PRESENTATION

Energy Efficiency Research in Corporate Real Estate

CoreNet Global & Rocky Mountain Institute

August 1st, 2006

9am - 5pm

Charrette Agenda

Introduction: Welcomes from CoreNet and RMI

Morning Session: Defining barriers

- ➡GOAL 1: Define key supply chain participants
- ➡GOAL 2: Define barriers experienced by each participant

Lunch: 12:30 - 1:30pm

Afternoon Session: Identify case studies and enablers

- ➡GOAL 3: Develop selection criteria and identify potential case studies
- ➡GOAL 4: Define enablers to overcome barriers identified in the morning session

Recap: Survey example

Summarize the day and set the agenda for the next few months

Project Participants

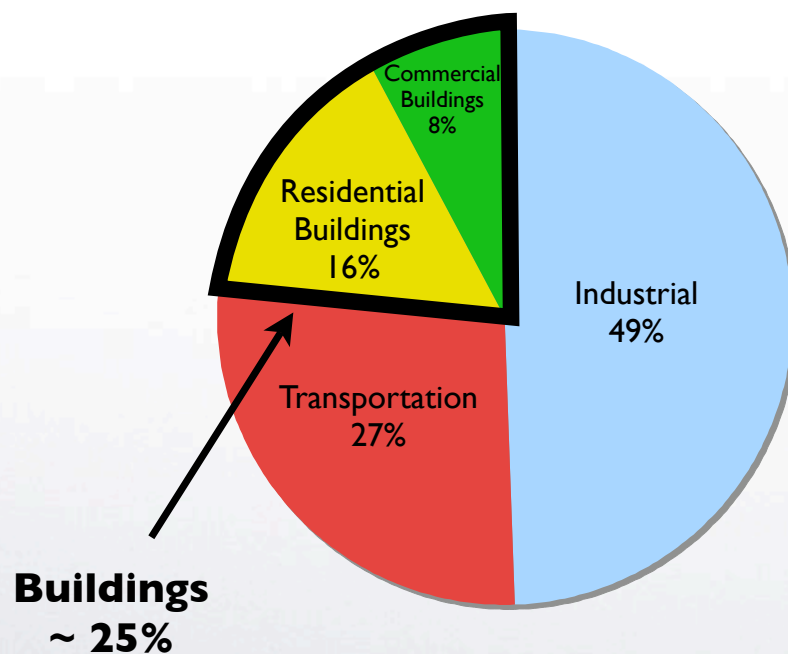
Facilitators: Eric Bowles & Ron Adams (CoreNet Global)
Greg Franta, Bill Browning, Aalok Deshmukh, Eric Maurer, & Caroline Fluhrer (RMI)

Advisory Team: Bill Sisson (United Technologies)	Kevin Oakes (Motorola)
Mike Harris (Johnson Controls)	Bill Frain & Pat Crumley (Staubach)
Tim Frank & Jim Cooke (Toyota Motors)	Stephen Smith (ABN Amro)
Gary Jensen (Ford Motors)	Johannes Ketel (Deutsche Bank)
Timo Salonen & Mia Ranta-Aho (Nokia)	Mary Ann Lazarus (HOK)
Mukesh Khattar (Oracle)	Bill Rodgers (Emcor Group)
John Schinter (Jones Lang LaSalle)	Jim Scannel (St. Paul Travelers)
Andy Bray (JCI - Europe)	Brad Hancock (Dept. of Defense)
Brenna Walraven (USAA Realty Company)	Joe Wick (Cushman & Wakefield)

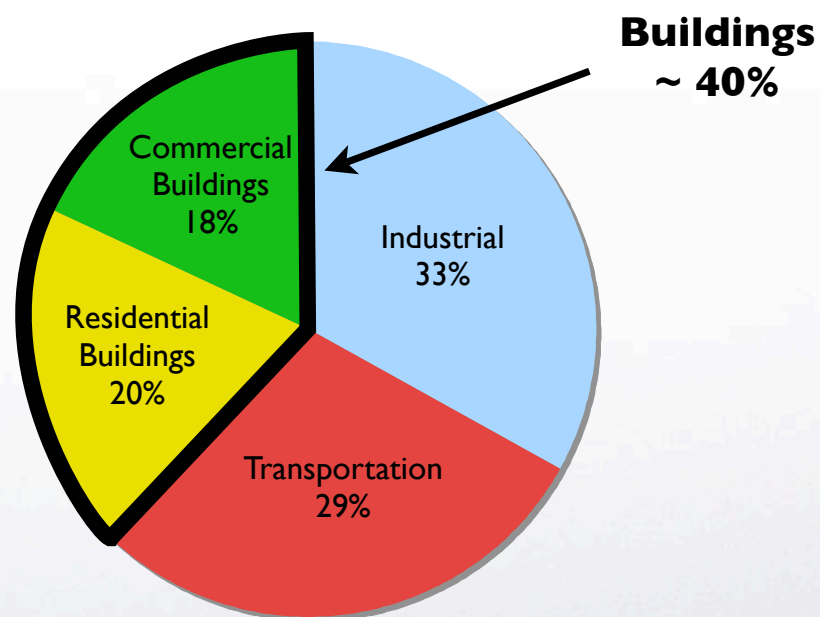
Survey Respondants: TBD

Buildings consume a lot of energy . . .

World Energy Consumption
by End-Use, 2003

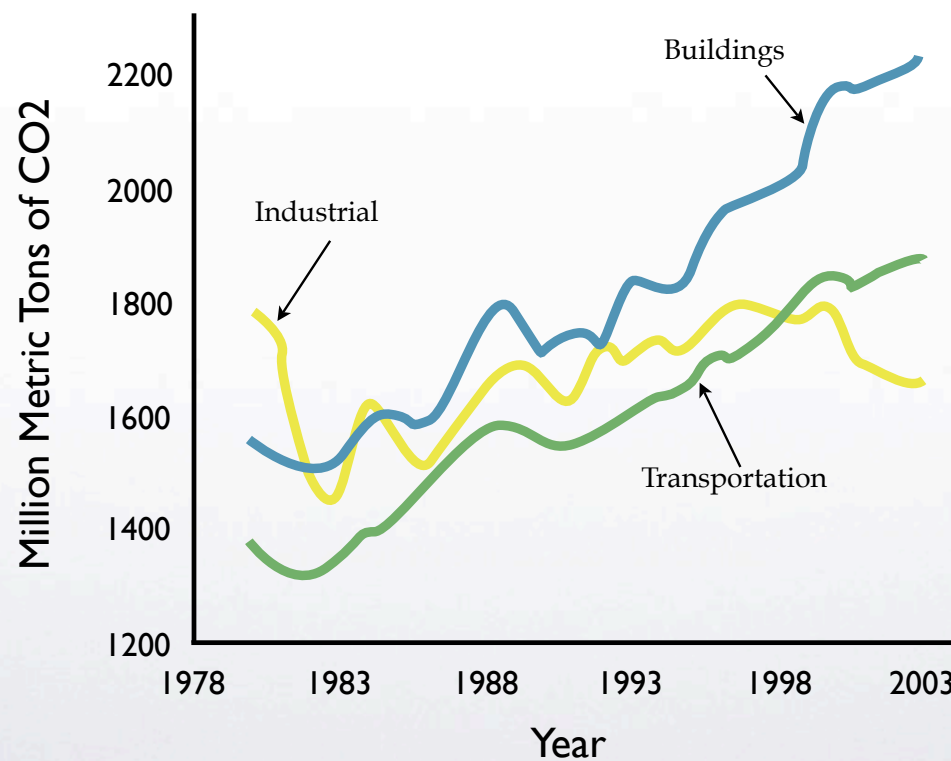


U.S. Energy Consumption
by End-Use, 2003



... and contribute significantly to CO₂ emissions

U.S. Carbon Emissions by End-Use Sector: 1980 - 2003



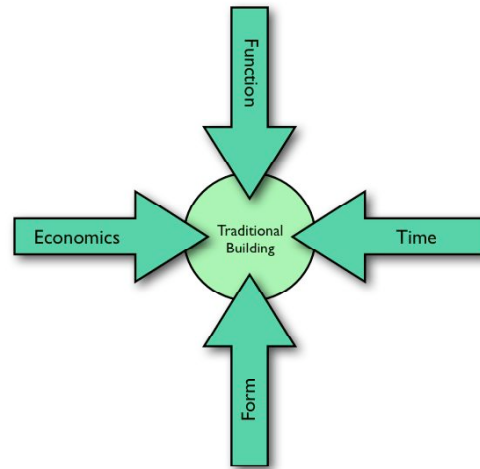
Data (2003) for figure from the 2004 Annual Energy Review

Are there opportunities for savings?

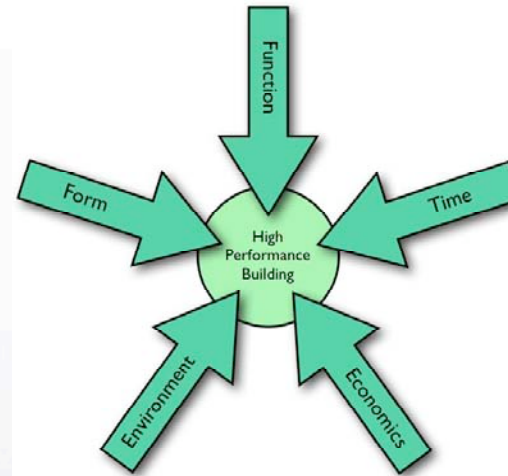
In most commercial, industrial, and institutional facilities, there are abundant opportunities to save **70-90 percent** of the energy and cost for lighting, fan, and pump systems, **50 percent** for electric motors, and **60 percent** in areas such as heating, cooling, office equipment, and appliances.



How can we exploit these savings?

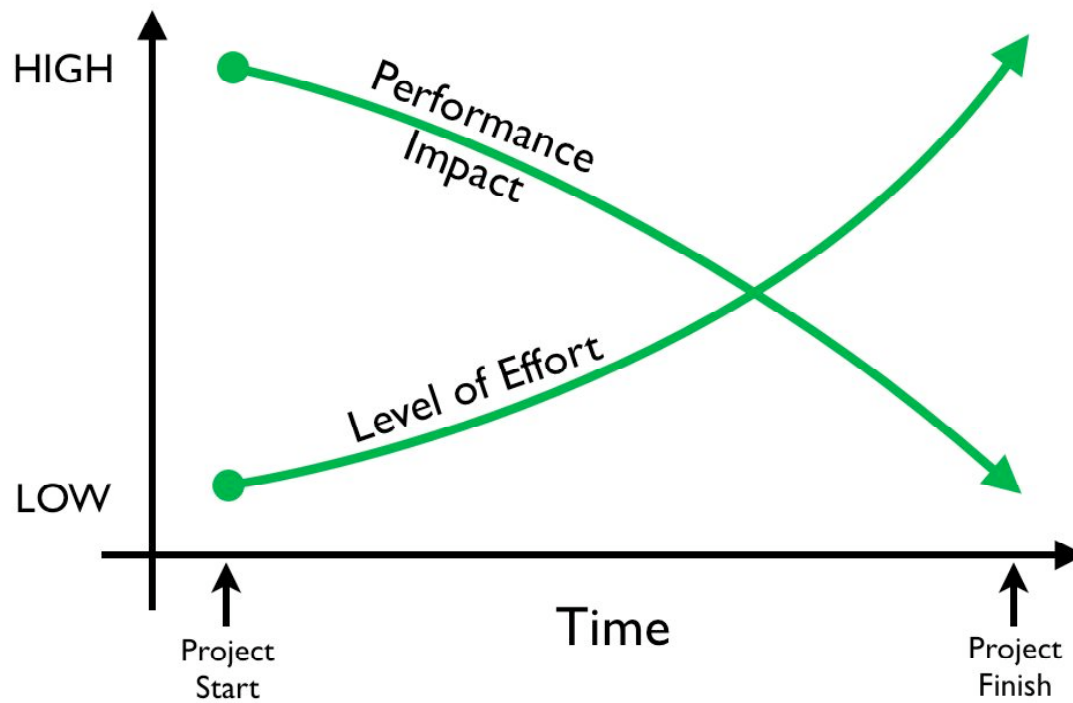


Traditional Design



Integrated Design

Early Impact



Why are savings remaining untapped?

“It is inconceivable that in a market economy, such large and profitable savings would remain untapped. But **to a practitioner who knows how buildings are created and run**, it is not only conceivable but obvious.”

- Amory Lovins

Why are such “large and profitable” savings remaining untapped?

What is wrong with the way buildings are created and operated?

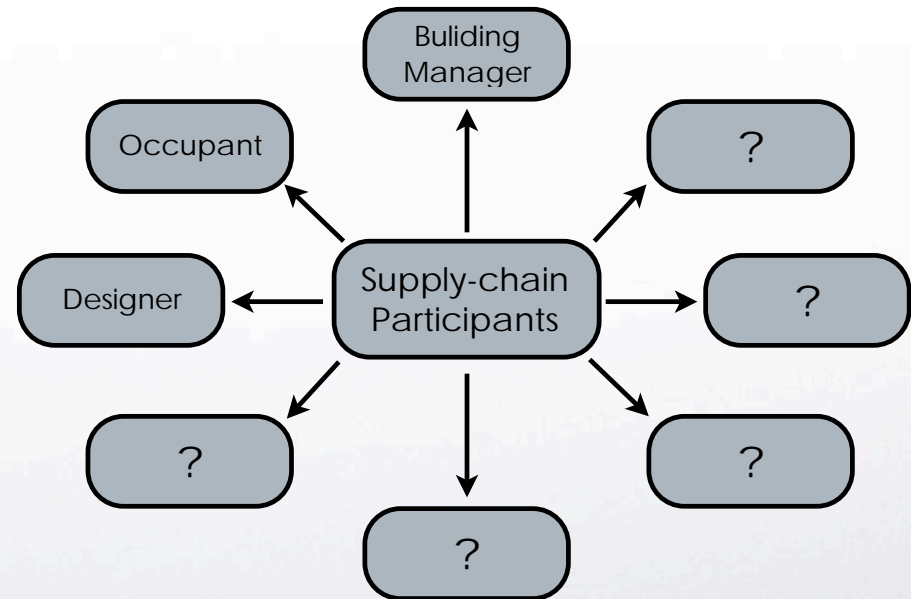
What is standing in the way of these “practicioners?”

Our Purpose

To supply large corporations with strategies to remove or overcome barriers to realizing greater energy efficiency

How will we do this?

- I Identify key supply-chain participants

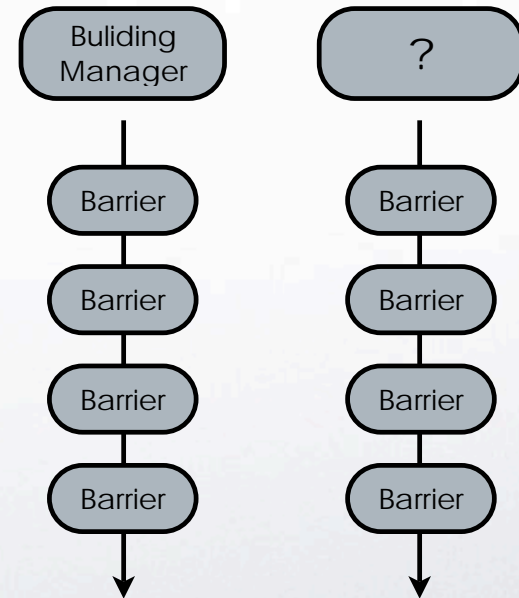


Our Purpose

To supply large corporations with strategies to remove or overcome barriers to realizing greater energy efficiency

How will we do this?

- 1 Identify key supply-chain participants
- 2 Identify barriers facing each supply-chain participant

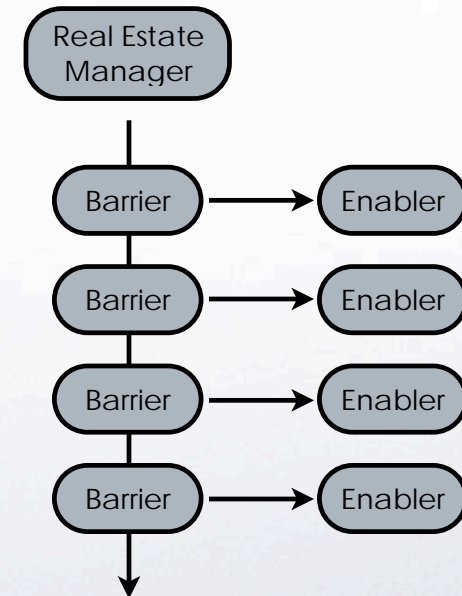


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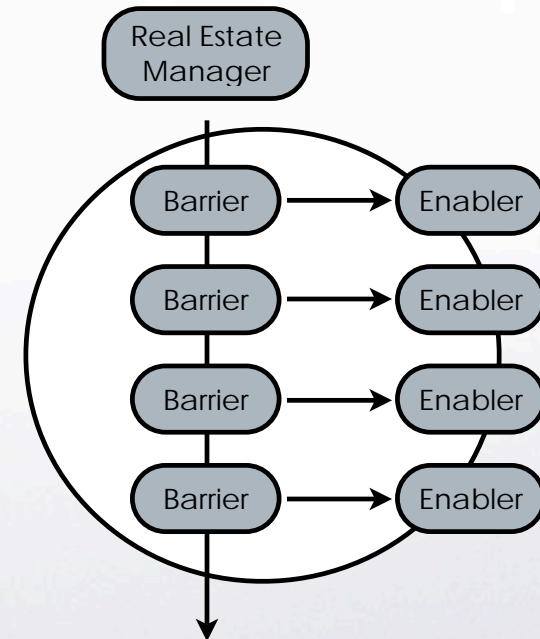


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- 4 Develop case studies that highlight success stories

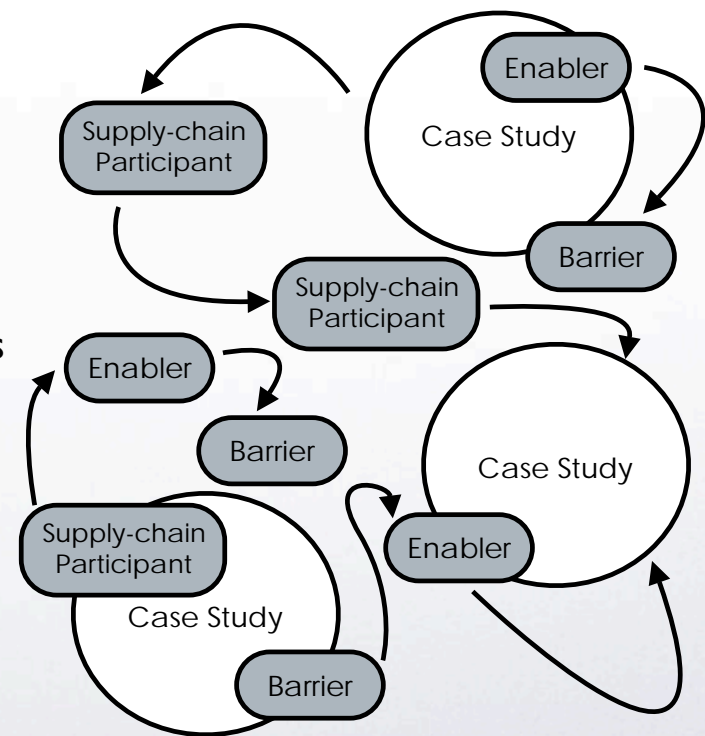


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- 3 Identify enablers to overcome or remove these barriers
- 4 Develop case studies that highlight success stories
- 5 Summarize findings in a functional written report
- 6 Distribute and present findings

Target Audience:
Large Corporations

Distribution Mechanisms:
TBD

A Starting Point

Energy-Efficient Buildings: Institutional Barriers and Opportunities
Amory Lovins & E SOURCE - 1992

Participants

Barriers

Real-estate developers	→	Focus exclusively on \$/sf
	→	Believe energy efficiency measures will increase first cost
Brokers & Bankers	→	Paid based on value of deal, not long-term financial performance
Appraisers	→	Cannot quantify value of energy efficiency measures
	→	Value location and aesthetics, not energy efficiency

Architect

- Percentage or flat-fee contract does not incentivize extra effort
- Delegates work to outside consultants
- Uses rules-of-thumb design

Mechanical Engineer

- Oversizes equipment to avoid liability
- Leaves sizing exercise to manufacturers
- Does not build energy model for project
- Does not like architect

Project Manager

- Does not emphasize whole-systems design
- Pushes budget & schedule not goal setting or communication
- Involves key project players too late in the game

Owner

- Takes low-bids for design/construction work
- Knows of few examples of cost-effective energy-efficient design

- | | |
|-----------------------|--|
| Building Manager | → Paid to make things work, not to make them work efficiently |
| | → Has inadequate systems monitoring or interfaces |
| | → Does not receive enough training on building systems |
| Multi-tenant occupant | → Pays flat rate per sf for energy |
| | → Neighbors benefit equally from any energy-efficiency measures your company completes |
| Contractor | → Availability often dictates equipment or material selection |
| | → Is unfamiliar with project goals and sensitivities |

Who else?

What else?

Considerations

How should we group supply-chain participants?

Do we need to further dissect each supply-chain participant?

Terminology ... Does building manager imply the same thing as facility manager?



INTERNAL PARTICIPANTS

Finance Department
Real Estate Manager
Building Manager
Construction Manager

EXTERNAL PARTICIPANTS

Contractor
Architect
Engineer
Consultant

DESIGN TEAM

Contractor
Architect
Engineer

TENANT

Facilities department
Business Unit using space
Real estate department
Corporate management

FACILITIES

Technician
Manager